Texas City Channel Deepening Project
Draft General Reevaluation Report
And
Environmental Assessment

1.0 STUDY INFORMATION

1.1 INTRODUCTION

The Water Resources Development Act (WRDA) of 1986 authorized a 50-foot project depth for the Texas City Channel. The authorization provided for a 50-foot project depth from the offshore entrance channel through the Texas City inner harbor. None of the 50-foot project features were constructed. The Non-Federal Sponsor's current interest is limited to a project depth of 45 feet. In a letter to the Galveston District U.S. Army Corps of Engineers (USACE) dated April 12, 2001, the Non-Federal Sponsor, the City of Texas City, requested reactivation of the Texas City Channel project. Their request was based on the emergence of the Shoal Point Container Terminal project and the Port of Texas City and the Texas City Channel users' renewed interest in deepening the Texas City Channel and existing turning basin to a depth of 45 feet. In correspondence dated November 12, 2002, the City of Texas City, the Port of Texas City, and the Texas City Channel users reaffirmed their support for the project and requested that USACE focus only on deepening the Texas City Channel project to a depth of 45-feet and maintaining the existing 400 feet width.

The project is located on the upper Texas coast extending from the Galveston Bay mainland shoreline at Texas City, through the jettied Galveston Entrance Channel, to deep water in the Gulf of Mexico. Galveston Bay is the largest estuarine system on the Texas coast and provides access to the principal ports of Houston, Texas City, and Galveston.

The Texas City Channel is a Federal deep-draft navigation project serving the Port of Texas City in Galveston County, Texas (Figure 1). It consists of a main channel connecting a turning basin at the port to the Gulf of Mexico through Bolivar roads, a part of the Houston Ship Channel (HSC). The main channel is 40 feet deep, 400 feet wide and about 6.8 miles long. The turning basin is 40 feet deep, 4,253 feet long, and ranges from 1,000 to 1,200 feet wide. An Industrial Canal, 40 feet deep and 300 to 400 feet wide extends 1.7 miles southwestward from the south end of the turning basin. The Texas City Channel is protected from cross currents and shoaling by the Texas City Dike, which consists of a pile dike 28,200 feet long, parallel to and north of the channel; and a rubble-mound dike, 27,600 feet long, along the southerly side of the pile dike. The 40-foot channel was completed in June 1967. Widening and realigning of the Texas City Turning Basin and enlargement through widening and deepening of the Industrial Canal and basins was initiated in July 1980 and completed in June 1982. The authorized work remaining is deferred construction consisting of widening the Industrial Canal from 250 feet to 300 feet at a 40-foot depth.

Figure 1. Project area including the Texas City Channel, Turning Basin and Industrial Canal.

1.2 PROJECT AUTHORITY

Section 201 of the Water Resources Development Act of 1986, Public Law 99-662, dated 17 November 1986, authorized the Texas City Channel 50-Foot project. The applicable portion of the Act reads as follows:

> *"The project for navigation, Galveston Bay Area, Texas City Channel, Texas: Report of the Chief of Engineers, dated March 11, 1986, at a total cost of $200,000,000, with an estimated first Federal cost of $130,000,000 and an estimated first non-Federal cost of $70,000,000."*

Work authorized, but not constructed, by WRDA 1986 included deepening the Texas City Turning Basin to 50 feet, enlarging the 6.7-mile long Texas City Channel to 50 feet by 600 feet, deepening the Bolivar Roads Channel and Inner Bar Channel to 50 feet, deepening the Outer Bar and Galveston Entrance Channels to 52 feet, and extending the Galveston Entrance Channel to a 52-foot depth for 4.1 miles at a width of 800 feet and an additional reach at a width of 600 feet to the 52- foot contour in the Gulf of Mexico. Establishment of 600 acres of wetland and development of water-oriented recreational facilities on a 90-acre enlargement of the Texas City Dike were also authorized but never constructed because the non-Federal sponsor, the City of Texas City was unable to secure funding to initiate plans and specifications in 1989. In recent years the size and draft of vessels using the Texas City channel have increased to meet the competitive demand for more efficient movements of bulk commodities, in particular crude petroleum and petroleum products. In 2001, the City requested deepening the channel to 45 feet to accommodate that demand. The City did not request deepening the channel to the authorized depth of 50 feet due to potential high project costs and environmental concerns.

The currently proposed project is less in scope than the authorized project. The total project cost that was authorized was $200,000,000.00. The Fully Funded project cost for the current proposal is $58,485,948. Therefore the Section 902 Cost Limit would not apply.

1.3 SHOAL POINT CONTAINER TERMINAL PERMIT

In April 2003 the City of Texas City received a USACE Permit authorizing the construction of a six-berth marine container terminal including utility lines, an access roadway, wharves, berthing areas, turning basin and the deepening of the Texas City Channel to -45 feet MLT from the northern end of the turning basin to the area known as the Texas City wye. The terminal facility would be constructed on approximately 400 acres of an active, leveed dredged material placement area (PA) known as Shoal Point, which is the primary PA used for the placement of dredged material from the Texas City Channel. During the development of the Environmental Impact Statement (EIS) for the Permit, a 50-year Dredged Material Management Plan (DMMP) was developed, not only to accommodate the dredged material from the berthing areas and the deepening of the channel, but to also include the maintenance material from the channel, including the existing turning basin. Because 400 acres of disposal capacity will be utilized for construction of the terminal, the City of Texas City is required to replace that lost capacity. This will be accomplished by the City constructing a 357 acre area known in the permit as Beneficial Use Site (BUS) 1 (Figure 2). BUS1 will be referred to in this report as Shoal Point PA 1 (SPPA) 1.

1.4 PURPOSE AND SCOPE

The primary purpose of the Texas City Channel project is to improve the navigational efficiency and safety of the existing waterway for movement of commerce and national security needs. An environmental opportunity also exists through the utilization of dredged material beneficially. Recreation demands and needs of the area may also be addressed by using dredged material to enlarge the beach areas north of the Texas City Dike.

This report presents the problems and opportunities, and expresses desired outcomes as planning objectives. Alternatives have been developed to address these objectives. These alternatives include a plan of no action and various combinations of structural and non-structural measures. The economic and environmental impacts of the alternatives were then evaluated and a feasible plan was selected. The report also presents details on USACE and Non-Federal Sponsor participation needed to implement the plan. The report concludes with the identification of a recommended plan.

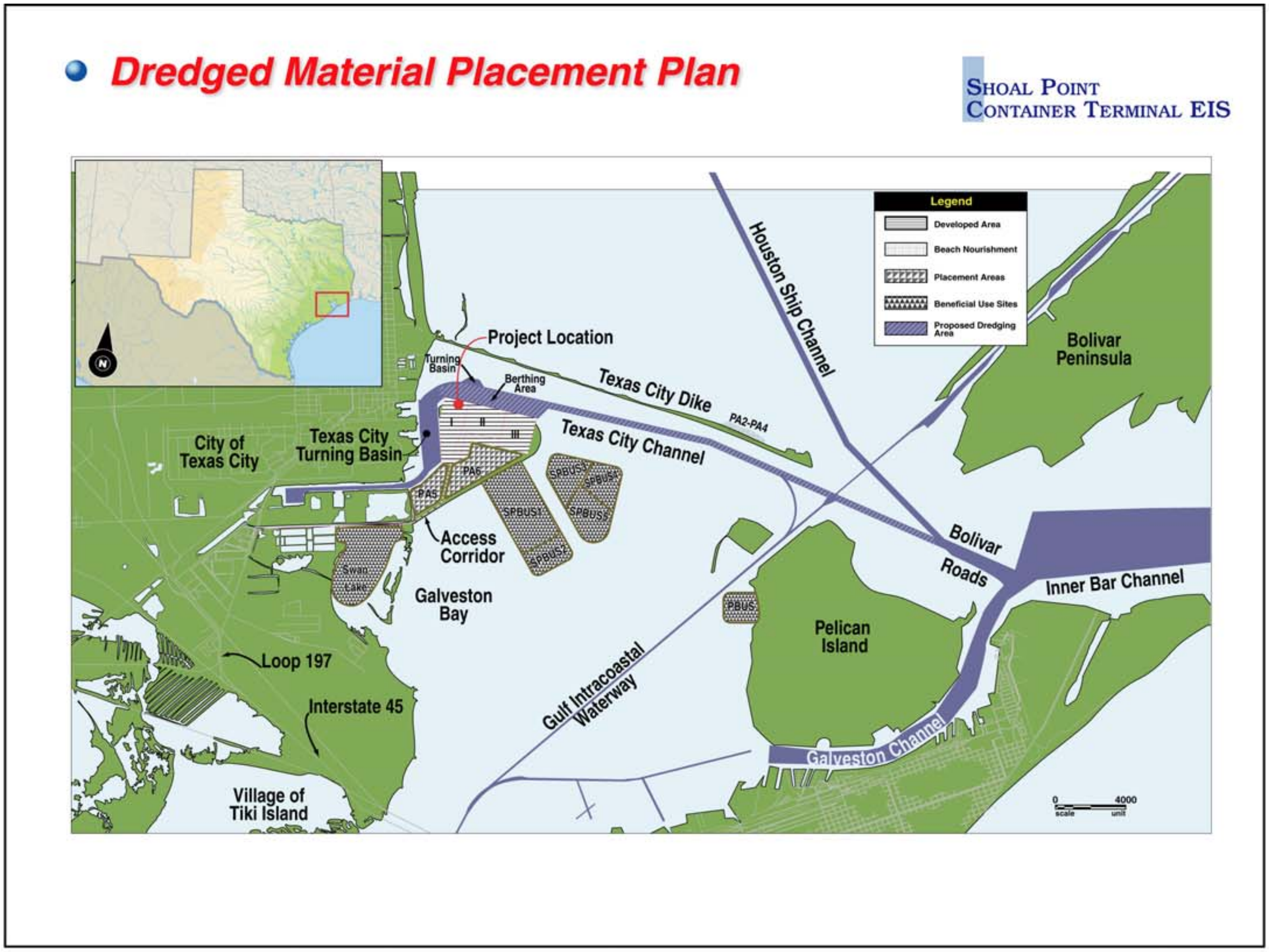


Figure 2. Footprint of Dredged Material Placement Plan, including SPPA1, authorized under USACE Permit 21979.

1.5 PROJECT AREA DESCRIPTION

Galveston Bay is an estuary of approximately 600 square miles in surface area, and is generally shallow, with typical depths in the interior of the bay ranging from 5 to 12 feet (Figure 3). Depths in central Galveston Bay are variable because of the presence of oyster reefs. Dredged navigation channels, with depths ranging from 12 to 45 feet, transect the bay system. The bay consists of several subsystems: Trinity Bay, East Bay, the confined portion of the Houston Ship

Channel (HSC) above Morgan's Point, San Jacinto Bay, upper Galveston Bay (consisting of the area north of the Texas City Dike and west of the HSC), and West Bay.

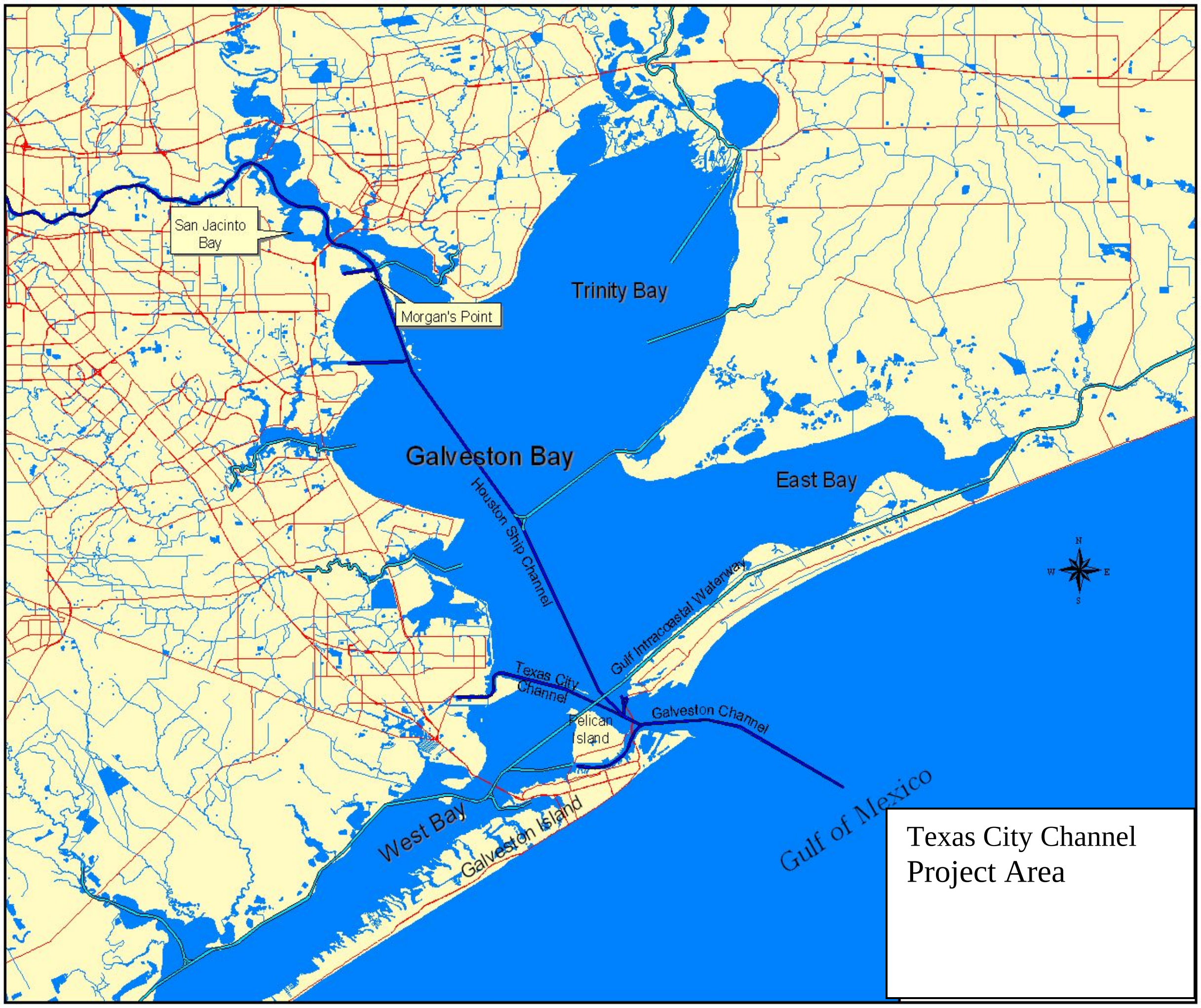


Figure 3. Project Area of Texas City Channel Deepening Project

An important feature in the bay system is the Texas City Dike along the west shore of Galveston Bay. This structure, which has existed in the Bay system in various forms since 1915, exerts an influence on the currents in the Bolivar Roads area and reduces the exchange of water between Galveston Bay and West Bay. At the same time, it reduces currents and sedimentation in the Texas City Channel.

Galveston Bay and its associated bays are separated from the Gulf of Mexico by a system of barrier islands and peninsulas. The main navigation channels in Galveston Bay include Galveston Harbor (the channel complex composed of the Entrance Channel, the Outer Bar Channel, and the Inner Bar Channel); Galveston Channel between Pelican Island and Galveston Island; the Texas City Channel; the HSC, which crosses the lower and upper Galveston Bays;

and the Gulf Intracoastal Waterway (GIWW). Dredged material has been placed along most of these channels.

The portion of the Gulf of Mexico pertinent to the project area is the relatively shallow shelf area near the coast, which is largely devoid of significant physical features. The shelf slopes fairly uniformly at a rate of approximately 1 foot vertical to 2,000 feet horizontal, except within approximately 3,000 feet of the beach where the slope is steeper, about 1 foot vertical to 200 feet horizontal.

The coastal plain in the project area consists of a series of coastal terraces dipping gently seaward, with surface gradients ranging from less than 1 foot per mile near the coast to about 10 feet per mile along the inland margin to the coastal plain. These terraces are transversed by the floodplains of the San Jacinto and Trinity River valleys. The land surface of the coastal plain typically has little variation in elevation and generally does not have prominent terrain features.

1.6 HISTORY OF THE PROJECT

On March 4, 1913, the Texas City Channel was first authorized by House Document (H. Doc.) 1390, 62nd Congress, 3rd Session. The first project allowed for the construction of a pile dike and a 30 feet deep by 300 feet wide channel. Authorization was passed on July 3, 1930 for a harbor 800 feet wide and a rubble-mound dike, as described in H. Doc. 107, 71st Congress, 1st Session. Improvements to these basic features began in 1935 and are summarized by date of authorization in Table 1.

Table 1

Summary of Historical Authorizations

Date	*Work Authorized*	*Authorizing Documents*
Mar 4, 1913	Construct a channel (300 feet wide by 30 feet deep) and a pile dike along its north side	H. Doc. 1390, 62nd Congress, 3rd Session
Jul 3, 1930	Construct a harbor (800 feet wide and 30 feet deep) and a rubble-mound dike	H. Doc. 107, 71st Congress, 1st Session
Aug 30, 1935	Extend rubble-mound dike to shoreline	Rivers and Harbors Committee Doc. 4, 73rd Congress, 1st Session
Aug 30, 1935	Deepen channel and harbor to 32 feet	Rivers and Harbors Committee Doc. 46, 73rd Congress, 2nd Session
Aug 30, 1936	Deepen channel and harbor to 34 feet	Rivers and Harbors Committee Doc. 62, 74th Congress, 1st Session
Aug 26, 1937	Extend harbor 1,000 feet southward, 800 feet wide by 34 feet deep	Rivers and Harbors Committee Doc. 47, 75th Congress, 1st Session

Date	Work Authorized	Authorizing Documents
Jun 30, 1948	Deepen channel and harbor to 36 feet, widen channel to 400 feet and harbor to 1,000 feet, and change name of channel from "Channel from Galveston Harbor to Texas City, Texas" to "Texas City Channel"	H. Doc. 561, 80th Congress, 2nd Session
Jul 14, 1960	Deepen channel and turning basin to 40 feet and construct a 16 feet deep, 1.9-mile long Industrial Canal.	H. Doc. 427, 86th Congress, 2nd Session
Oct 12, 1972	Widen the existing Texas City Turning Basin to 1,200 feet, including relocation of the basin 85 feet to the east; provide a 40 feet deep channel in the Industrial Canal at widths of 300 to 400 feet, with a turning basin at the head of the canal 40 feet deep, 1,150 feet long, and 1,000 feet wide; ease the bend at the entrance of the canal; and reauthorize shallow-draft Industrial Barge Canal not incorporated in plan of improvement above	H. Doc. 199, 92nd Congress, 2nd Session (Section 201, PL 89-298)
Nov 17, 1986	Deepen the Texas City Turning Basin to 50 feet, enlarge the 6.7-mile-long Texas City Channel to 50 feet deep by 600 feet wide, establish 600 acres of wetlands, and develop water-oriented recreational facilities on a 90-acre enlargement of the Texas City Dike (not constructed)	Section 201, PL 99-662
Apr 12, 2001	The City of Texas City requested reactivation of the Texas City Channel project. Their request was based on the emergence of the Shoal Point Container Terminal project and the Port of Texas City and the Texas City Channel Users' renewed interest in deepening the Texas City Channel and existing turning basin to a depth of 45 feet	

1.7 NON-FEDERAL SPONSOR AND COORDINATION

The USACE Galveston District is responsible for the overall management of the study and the report preparation. The City of Texas City is the Non-Federal Sponsor for the study. The study is being coordinated with interested Federal, State, and local agencies and the public. The following are some of the agencies and groups that provided planning strategies and design input during the preparation of the report:

Federal Agencies

- U.S. Fish and Wildlife Service (USFWS)
- U.S. National Marine Fisheries Service (NMFS)
- U.S. Environmental Protection Agency (EPA)
- U.S. Coast Guard (USCG)
- U.S. Customs Service
- U.S. Department of Homeland Security

Texas State Agencies

- Texas Commission on Environmental Quality (TCEQ)
- Texas General Land Office (TxGLO)
- Texas Parks and Wildlife Department (TPWD)
- State Historic Preservation Officer (SHPO)
- Texas Department of Transportation (TXDOT)
- Texas Railroad Commission (TXRRC)

Texas Local Interest Groups

- Port of Texas City
- Texas City International Terminals (TCIT)

1.8 PRIOR PROJECTS AND REPORTS

A number of reports concerning the project or project area have been completed over the years. The following were reviewed as part of the reevaluation study:

1) Interim Feasibility Report and Environmental Impact Statement, Texas City Channel Report, Vol. III, September 1982.

2) Texas City Channel, Texas (50-Foot Project) General Design Memorandum (GDM), USAED-Galveston, January 1989.

3) Texas City Channel, Texas, Project Review and Assessment, USAED-Galveston, September 1997.

4) Dredged Material Management Plan, Shoal Point Container Terminal, Berger/Abam Engineers Inc., August 2001.

5) Shoal Point Container Terminal Project, EIS, USAED-Galveston, November 2002. Permit No.21979.

Report numbers one through three above were completed for the Texas City Channel Federal Project and appropriate information from the reports will be utilized as needed. Reports four and five were completed for a USACE Permit No. 21979 for the Shoal Point Container Terminal Project.

The Shoal Point Container Terminal Project, EIS (2002) and the DMMP, Shoal Point Container Terminal (2001) report were heavily utilized for existing conditions information and the basis for the DMMP for the recommended project. The Shoal Point Container Terminal Project was extensively coordinated with all appropriate Federal, State and local governmental agencies, as well as environmental organizations and the general public from the surrounding local communities. All authorizations required for a Federal activity from Federal, State and local governmental entities were granted.

1.9 PLANNING PROCESS AND REPORT ORGANIZATION

The most recent report completed by USACE for the Texas City Channel Federal Project was a Project Review and Assessment in September 1997. This report concluded that the authorized project continued to be economically justified and environmentally sound, but the potential existed for further improvements based on knowledge gained from more recent studies.

In November 2002 an EIS was completed for USACE Permit No. 21979 for the Shoal Point Container Terminal Project which included the deepening of the Texas City Channel to 45 feet. This assessment incorporates, by reference, data and information pertaining to the Texas City Channel Deepening Project from the Shoal Point Container Terminal EIS. 33 CFR 230.21 provides the authority to adopt a Federal agency's EIS in full or partial compliance of NEPA. The November 2002 permit EIS will be made available on the Galveston District USACE internet site address http://www.swg.usace.army.mil/ so reviewers of the current NEPA document can reference the approved EIS. If reviewers do not have internet access, a copy of the EIS on compact disc will be made available by contacting Jake Walsdorf.

This reevaluation study follows the recommendations given in the Project Review and Assessment. Those recommendations were that the required reevaluation of the project be based on current conditions, detailed design of the resultant recommended plan, environmental coordination, execution of a Project Cost-Sharing Agreement (PCA), and ultimately project construction.

The study process provided for a systematic preparation and evaluation of alternate plans which address study area problems and opportunities. The process involved all of the six functional planning steps:

- Specify Problems and Opportunities
- Inventory and Forecast Conditions
- Formulate Alternative Plans
- Evaluate Effects of Alternative Plans
- Compare Alternative Plans
- Select Recommended Plan

The following are some of the issues that were addressed in this reevaluation study and environmental analysis in consultation with State and Federal resource agencies and the public:

- Channel Design Optimization
- Ship Simulation Study
- Dredging Quantity Estimates
- Maintenance Patterns and Shoaling Rates

- Geotechnical Investigations for Levee Stability
- 50-Year DMMP
- Beneficial Uses of Dredged Material
- Pipeline Relocation Requirements
- Hydrodynamics of the Estuary
- Marine / Estuarine Resources
- Sediment and Water Quality
- Endangered Species
- Cumulative Impacts
- Cultural Resources

The chapter headings and order in this integrated report generally follow the outline of an Environmental Impact Statement. However, this report contains an Environmental Assessment. Chapters of the report relate to the six steps of the planning process as follows:

* The second chapter of this report, **Problem Identification**, covers a portion of the first step in the planning process (specification of water and related land resources problems).

* The third chapter of this report, **Formulation Objectives, Constraints and Criteria**, addresses the remainder of step one in the planning process by identifying the potential water and related land resource opportunities, while addressing the concerns, planning objectives, identifying potential constraints, and developing the criteria to be used for evaluating plan formulation alternatives.

* The fourth chapter of this report, **Plan Formulation**, is the heart of the report and is therefore placed before the more detailed discussions of resources and impacts. It covers the third step in the planning process (formulation of alternatives), the fifth step in the planning process (comparison of alternative plans), and the sixth step of the planning process (selection of the recommended plan).

* The eighth chapter of this report, **Affected Environment**, covers the second step of the planning process (inventory, forecast and analysis of water and related land resources in the study area).

* And, the ninth chapter of this report, **Environmental Consequences**, covers the fourth step of the planning process (evaluation of the effects of the alternative plans).

2.0 PROBLEM IDENTIFICATION

2.1 OVERVIEW

The Texas City Channel continues to play a significant role in the growth and economic development of the Galveston, Texas City and Houston area. As growth and economic development of the study area continue, the need for more efficient movement of commodities increases, particularly crude petroleum, but also the proposed container vessel traffic.

With the current channel dimensions the tonnage is not being moved as efficiently due to the size restrictions of the larger tankers utilizing the channel. These tankers are primarily limited by the current depth of 40 feet.

2.2 NAVIGATION AND COMMERCE

Texas City's port experienced strong growth over the past decade, increasing from an average of 45 million short tons for 1990-91 to 58 million for 2000-02. The USACE national statistics show Texas City ranking 9th in the Nation in terms of total tonnage in 2003, up from 13th in early 1990's. The existing 40-foot project depth was designed to efficiently and safely accommodate vessels of approximately 40,000 Dead Weight Ton (DWT) with loaded drafts of 36 feet. Since the authorization of the existing project, the size and draft of vessels using the Texas City Channel have increased to meet the competitive demand for more efficient movements of bulk commodities, in particular crude petroleum and petroleum products. Texas City primarily serves as a crude petroleum, and petroleum and chemical product port. In addition to its existing petroleum and chemical tonnage base, the city of Texas City was issued a permit for the development of the Shoal Point Container Terminal in 2003.

Examination of the vessel sizes used for petroleum product imports and loading patterns at other Gulf Coast ports shows that up to 51 percent of product imports are transported in vessels with loaded drafts over 40 feet. Initial review shows that over 20 percent of petroleum coke export tonnage from other U.S. ports for 2001-02 were shipped in vessels with loaded drafts over 40 feet. Initial investigations suggest that between 50 and 80 percent of Texas City crude petroleum imports would benefit from a deeper channel. Deepening the Texas City Channel would improve transportation efficiency for larger vessels entering the Texas City Port area and eliminate the need to light-load vessels or perform offshore lightering of vessels.

2.3 SAFETY AND NATIONAL SECURITY

In light of recent world events, global concern regarding acts of international terrorism and organized crime has increased, leading to heightened domestic and international security at U.S. ports. Efforts led by the U.S. Customs Service, USCG and World Customs Organization have increased port security by requiring more stringent vessel inspections, deploying additional monitoring vessels, and increasing terminal owner/operator security measures. Programs such as Operation Noble Eagle, Operation Neptune Shield and additional Maritime Homeland Security concepts and strategies have been integrated into the daily operations of ports through coordination of USCG resources and partnerships with the maritime community and local law enforcement agencies. These partnerships are working to increase the local network of and interaction between Federal, State, and local law enforcement and intelligence agencies.

Texas City ranked among the top ten U. S. ports for the most recent 4-year period. It is one of the Nation's most important ports for the petro-chemical industry. A deeper channel which allows for safer and more efficient movement of crude and petroleum products is not only an economic benefit to the U.S. but also makes the channel safer for ship traffic and brings the U.S. a step closer to being more self-sufficient in the refining of fossil fuels. This can ultimately contribute to our national security. Improvements to navigation and the continued cooperation between international and national agencies and the private business sector contribute to the security of our Nation and its ports. In August 2000, during the development of the Shoal Point Container Terminal EIS, a Ports and Waterways Safety Assessment Workshop was held at the Texas City Port facility specifically to discuss port security. Representatives from public agencies and private sector interests were present including USCG.

2.4 ENVIRONMENTAL

The Galveston Bay system historically has been subject to the loss of wetlands. Both natural and artificial processes, including human-induced subsidence and relative sea level rise as well as draining and filling wetlands for development, have resulted in the conversion of wetland habitats to open water or upland habitat. The placement of dredged material presents an opportunity to benefit the ecology of Galveston Bay. Dredged material from the proposed project would be used beneficially to create intertidal marsh habitat.

3.0 FORMULATION OBJECTIVES, CONSTRAINTS, AND CRITERIA

3.1 OVERVIEW

This chapter presents the results of the first step of the planning process, the specification of water and related land resources problems and opportunities in the study area. The chapter concludes with the establishment of planning objectives and planning constraints, which is the basis for the formulation of alternative plans.

3.2 NATIONAL OBJECTIVES

The fundamental national objective of Federal participation in water resources development projects is to assure that an optimum contribution is made to the welfare of all people. The Water Resources Council's Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies dated March 1983 and the National Environmental Policy Act of 1969 (NEPA) provide the basis for Federal policy for planning Federal water resources projects. These authorities have established the procedures for formulation and evaluation of water resources projects. Additional policies and regulations, derived from executive and legislative authority, further define the criteria for assessment of plan impacts, risk analysis, review and coordination procedures, and project implementation.

Current Federal policy dictates that National Economic Development (NED) is the primary national objective in water resources planning. NED objectives stress increasing the value of the Nation's output of goods and services and improving economic efficiency on a national level. The Federal objective of water and related land resources planning is to contribute to NED in a manner that is consistent with protecting the Nation's environment. Consequently, the resource's condition should be more desirable with the selected plan than under the without-project condition.

National objectives are designed to assure systematic interdisciplinary planning, assessment, and evaluation of plans addressing natural, cultural, and environmental concerns, which will be responsive to Federal laws and regulations. In addition to the selected NED plan, the proposed project includes environmental restoration features that will protect and enhance valuable habitat identified during the study.

3.3 PUBLIC CONCERNS

A number of concerns have been identified during the course of the study. Input was received through coordination with the non-Federal Sponsor, coordination with Federal and State agencies and public meetings. The majority of the concerns/comments from the public that are related to the establishment of planning objectives and planning constraints are:

- Encourage the beneficial use of dredged material for the construction of artificial bird islands and inter-tidal marsh.

- Expression of support for the proposed deepening to -45 feet.

3.4 PLANNING OBJECTIVES

The primary objective of Federal navigation activities is to contribute to the Nation’s economy while protecting the Nation’s environmental resources in accordance with existing laws, regulations, and executive orders. More specific planning objectives were identified by area residents and concerned State and Federal agencies or suggested by existing opportunities for improving the quality of life. Plans were formulated and evaluated with the following objectives in mind:

1) To improve the efficiency and safety of the deep-draft navigation system, and

2) To maintain or enhance the quality of the area’s coastal and estuarine resources.

3.5 PLANNING CONSTRAINTS

Plans must be formulated with regard to addressing the problems and needs of the area, taking into consideration future without-project conditions. The plans should identify tangible and intangible benefits and costs from economic, environmental, social, and regional perspectives. Institutional implementation constraints should also be identified. The formulation framework requires the systematic preparation and evaluation of alternative solutions to the recognized water resource-related problems within the study area. The process also requires that impacts of the proposed action be measured and results displayed or accounted for in terms of contributions to: NED, Environmental Quality, Regional Economic Development, and Other Social Effects. This is accomplished throughout the different sections within the report.

Interaction with other interests must be maintained throughout the planning process to avoid duplication of effort, minimize conflicts, obtain consistency, and assure completeness. The following constraints apply to this study:

- Fish and wildlife habitat affected by a project plan should be preserved, if possible;

- The study process and plans developed must comply with Federal laws and policies; and

- Alternative plans that resolve problems in one area should not create or amplify problems in other areas.

Current guidance specifies that the Federal objective of planning is to contribute to NED consistent with protecting the Nation's environment. The following general criteria are applicable to all water resource studies. They have generally guided the formulation of this study. Technical, economic, environmental, and social criteria have been established to guide the project development process. These criteria are discussed below.

3.6 TECHNICAL CRITERIA

Technical criteria require the preservation of adequate project dimensions to provide safe passage of commercial navigation traffic through this reach of the waterway while minimizing environmental impacts. These criteria require plans to be compatible with navigation needs and consistent with the requirements of the navigational equipment using this portion of the waterway and to provide a long-term plan for the placement of dredged materials in order to continue maintenance of the waterway in the future.

Formulation of alternative alignments and dredged material placement alternatives and their evaluation were accomplished by analysis of historical and projected shoaling rates, erosion causes and rates, and general structural and non-structural alternatives applicable for conditions which are specific to this area. Technical information, both historical data and specific information prepared for this project, used during this study included, but was not limited to, salinity model data, ship simulation results, aerial photography, historical dredging records, and previously published scientific reports related to this area.

3.7 ECONOMIC CRITERIA

The economic criteria require that tangible benefits attributable to projects exceed project costs. Project benefits and costs are reduced to average annual equivalent values and related in a ratio of benefits to costs (Benefits-to-Cost ratio or BCR). This ratio must exceed unity to meet the NED objective. Selected plans, whether structural, nonstructural, or a combination of both, should maximize excess benefits over costs; however, unquantifiable features must be addressed subjectively. These criteria are used to develop plans that achieve the objective of NED and provide a base condition for consideration of economically unquantifiable factors which may impact on project proposals.

All structural and nonstructural measures for navigation projects should be evaluated using the appropriate period of analysis and the currently applicable interest rate. Total annual costs should include amounts for operation, maintenance, major replacements, and mitigation, as well as amortization and interest on the investment.

3.8 ENVIRONMENTAL CRITERIA

The general environmental criteria for navigation projects are identified in Federal environmental statutes, executive orders, and planning guidelines. It is the national policy that fish and wildlife resource conservation be given equal consideration with other study purposes in the formulation and evaluation of alternative plans. The basic guidance during planning studies is to assure that care is taken to preserve and protect significant ecological, aesthetic, and cultural values, and to conserve natural resources. These efforts also should provide the means to maintain and restore, as applicable, the desirable qualities of the human and natural environment. Alternative plans formulated to improve navigation should avoid damaging the environment to the extent practicable and contain measures to minimize or mitigate unavoidable environmental damages. Particular emphasis was placed on the following:

- Protection, preservation, and improvement of the existing fish and wildlife resources along with the protection and preservation of estuaries and wetland habitats and water quality;

- Consideration in the project design of the least disruptive construction techniques and methods;

- Mitigation for project-related unavoidable impacts by minimizing, rectifying, reducing or eliminating, compensating, replacing, or substituting resources;

- Preservation of significant historical and archeological resources through avoidance of artifacts and mitigation of artifacts that cannot be avoided.

3.9 SOCIAL AND OTHER CRITERIA

Plans proposed for implementation should have an overall favorable impact on the social well-being of affected interests and have overall public acceptance. Structural and nonstructural alternatives must reflect close coordination with interested Federal and State agencies and the affected public. The effects of these alternatives on the environment must be carefully identified and compared with technical, economic, and social considerations and evaluated in light of public input.

4.0 PLAN FORMULATION

4.1 OVERVIEW

This chapter describes the development of alternative plans that address the planning objectives, the comparison of those plans and the selection of the recommended plan. It also describes the recommended plan and its implementation requirements.

4.2 PLAN FORMULATION RATIONALE

The planning framework requires the systematic preparation and evaluation of alternative ways of addressing problems, needs, concerns, and opportunities while considering environmental factors. The criteria and broad planning objectives previously identified form the basis for subsequent plan formulation, screening, and ultimately plan selection.

The planning process for this study has been primarily driven by the overall objective of reviewing and updating a comprehensive plan that would allow safe and efficient ship traffic along the Texas City Channel, while protecting the Nation's environmental resources. The first phase of this process was to review the existing authorization, PCA, and prior studies to establish the necessary level of review and identify areas of data collection needed to move forward with reevaluating the study. A limited array of alternative solutions to meet the existing and long-range future needs of the area was developed.

The expected future without-project (No Action) alternative was based on assumptions related to the City's request to utilize 400 acres of the existing, active dredged material PA for the proposed Shoal Point Container Terminal. As part of the Permit Special Conditions, the City is required to replace the lost capacity of the Shoal Point PA by constructing the SPPA1 to be located adjacent to the southeast portion of the existing PA and in accordance with the DMMP associated with the permit. For this study, the non-structural measures of one-way vessel traffic for piloted vessels and two-way traffic for tows, which is the current practice in the Texas City Channel, were reviewed. For the structural plans, four channel depths were evaluated and screened primarily utilizing information from the Texas City GDM, the Shoal Point Container Terminal EIS, and input from the Port of Texas City.

4.3 MANAGEMENT MEASURES AND PRELIMINARY PLANS

Future Without-Project Condition (No Action)
The USACE is required to consider "No Action" as one of the alternatives to comply with the requirements of the National Environmental Policy Act (NEPA). With the No Action plan, which is synonymous with the "Future Without-Project Condition," it is assumed that no new project would be implemented by the Federal Government or by local interests to achieve the planning objectives. The No Action Plan forms the basis against which all other alternative plans are measured.

The Future Without-Project Condition alternative includes retaining the 40 feet deep and 400 feet wide Texas City navigation channel. The current channel depth would continue to limit the efficient movement of commodities by vessels traveling the waterway. The efficiency of the channel would be further burdened by the fact that the adjacent Houston and Galveston entrance channels are currently dredged to -45 feet.

As vessels increase in draft, the restrictive depth of the waterway would prevent some vessels from entering with full loads or prevent larger vessels from even utilizing the waterway. The need to lighter products and/or light loaded vessels would increase, thereby increasing overall user costs and decreasing the efficiency of the vessels using the waterway.

One exception to the channel remaining at 40 feet, would be if the permitee for the Shoal Point Container Terminal deepened the Texas City channel to 45 feet with non-Federal funds. As outlined in the permit, the dredging of the channel would occur in their Phase II, approximately four years after the initial berth dredging for Phase I. Currently, the permittee is in year three of the five-year construction permit and work has not yet started on the Phase I berths. As with all USACE permits construction of the permitted project is not mandatory. It is up to the permitee to move forward with the project. The permittee is also the Non-Federal Sponsor for this project and at this time has indicated more interest in pursuing the channel dredging as a Federal Project. Regardless of work beginning on the container terminal, the permittee is responsible for replacing the lost capacity of 400 acres from the Shoal Point PA, due to the terminal's proposed development on the SPPA. Unless the permittee returns the land for use as a PA, the replacement PA needs to be constructed. For the reasons stated above the Future Without-Project Condition alternative assumes that SPPA1 and 1A will be in place.

Adverse impacts on natural resources in the region have resulted from general trends in population growth and economic development. Such effects are expected to continue as a result of development related to continued growth in the region. These impacts, and impacts resulting from the proposed action, combine and interact to result in cumulative effects on the region. Potentially adverse cumulative effects associated with past and continued future development of the area include loss of habitat, air and water quality impacts, and conversion of land uses. Beneficial effects of development in the region include new economic opportunities, housing alternatives, employment opportunities and recreational resources.

Alternatives

A management measure or alternative is a feature or activity at a site, which addresses one or more of the planning objectives. A wide variety of measures are usually considered. However, because this is a limited reevaluation of a previously authorized project, the measures that were considered in this study were limited.

Non-Structural

Non-structural measures of one-way vessel traffic for piloted vessels and two-way traffic for tows are the current practice for the Texas City Channel. The one-way traffic restriction is accommodated through the Pilots, the U. S. Coast Guard Vessel Traffic System (VTS), and Harbormaster communications. There are currently no plans to deviate from current practices.

Structural

Structural measures considered included alternatives for deepening and incidental widening of the existing Texas City channel. The deepening of the existing 40-foot channel would allow for existing and larger ships to more fully utilize the channel. A deeper channel will require more available PA for new work construction and continued maintenance of the channel. Any placement plan considered should ensure that the placement alternatives address the required capacities and minimize adverse impacts to the environment.

Locally Preferred Plan (LPP)

The locally or sponsored-preferred plan would deepen the Texas City Turning Basin and the Texas City Channel to -45 feet mean low tide. No widening of the channel would occur, other than the incidental widening that would result when deepening the channel to 45 feet while maintaining the existing bottom width. The Bolivar Roads Channel, Inner and Outer Bar Channels, and the Entrance Channel have already been deepened to a 45-foot project depth in conjunction with the deepening and widening of the Houston-Galveston Navigation Channel. Dredged material would be hydraulically pumped to two (2) existing PAs and used beneficially to create marsh habitat in proposed open-water PAs adjacent to Shoal Point in accordance with the DMMP in the Permit.

Final Array of Alternatives

The objective of a general reevaluation study is to arrive at a selected plan after a reasonable number of alternatives have been analyzed. This involves a comparison between each alternative and the future without-project condition consequences, considering economic, environmental and social impacts. Additionally, project alternatives were compared to the 1986 WDRA authorized 50-foot plan.

Project alternatives were determined by reviewing past studies and taking into consideration the currently maintained channel depth (40-foot) and the currently maintained Houston/Galveston Entrance Channel depth (45-foot).

The alternatives analyzed included:

- No Action Plan
- Deepening the channel to -43-foot (with incidental widening)
- Deepening the channel to -44-foot (with incidental widening)
- Deepening the channel to -45-foot (with incidental widening)
- Deepening the channel to -48 foot (with incidental widening)
- The Authorized 50-foot channel (with incidental widening)

The No Action Plan assumes that USACE would maintain the channel at the current 40-foot depth. If the City of Texas City, as the permittee for the Shoal Point Container Terminal development, deepens the channel to 45-feet, the USACE would maintain the channel only if the channel depth shoals to less than 40–foot.

5.0 ECONOMIC EVALUATION

5.1 OVERVIEW

Per ton FY2005 transportation costs for channel depth alternatives of 43, 44, 45, 48 and 50 feet were compared with the existing 40-foot channel depth. The project benefits were calculated for a 50-year period of analysis using Economic Guidance Memorandum 05-01 deep-draft vessel operating costs and the FY2006 Federal discount rate of 4.875 percent. The first year of the project life is expected to be 2010. The project benefits are based on reductions in transportation costs stemming from more efficient vessel loading and a higher utilization of larger vessels.

5.2 WITHOUT PROJECT CONDITION

The Texas City Channel complex contains 34 waterfront facilities. Six large industrial concerns operate and/or jointly operate a total of 15 facilities equipped to handle crude oil and petroleum and chemical products. There are three that receive crude petroleum, all of which can accommodate tankers in excess of 150,000 Dead Weight Ton (DWT). The majority of project benefits are for crude petroleum. The remaining facilities handle liquid bulk materials and dry cargoes. In addition, the Port of Texas City was issued a permit for the private development of the Shoal Point Container Terminal in 2004. Initial groundbreaking for the container terminal began early in 2005. For purposes of the Federal project and the GRR analysis, the operation of the container terminal is part of the without project condition.

In 2003, Texas City ranked 9th in the U.S. in tonnage volume, with 61.3 million short tons. Texas City ranked among the top ten U.S. ports for the most recent 4-year period. Texas City's recent total tonnage volumes represent record highs, and comparison of 1991-03 Texas City tonnage with that for the U.S. reveals that Texas City average annual growth rate of 2.8 percent for total deep-draft tonnage is more than twice the national average annual growth rate of 1.2 percent. The USACE 2004 records became available after preparation of the draft report and are referenced as footnotes to applicable tables.

Approximately 80 percent of Texas City's 61.3 million 2003 tonnage total consists of deep-draft ocean-going movements. The remaining 20 percent, a total of 12.6 million short tons, consists of shallow-draft GIWW traffic. Eighty-one percent of 2000-03 crude oil tonnage was shipped in vessels greater than or equal to 90,000 DWT with median design drafts of 45 feet or more. Nearly 75 percent of crude oil tonnage was shipped in vessels with loaded drafts greater than 36 feet and nearly 90 percent was shipped in vessels with design drafts over 40 feet[1]. Current traffic generally consists of one-way traffic for deep-draft piloted vessels and two-way traffic for inland waterway tows.

[1] U. S. Army Corps of Engineers, Waterborne Commerce of the United States, Navigation Data Center, detailed data files.

Table 2 presents Texas City 1990-03 total tonnage and principal deep-draft movements. Crude petroleum consistently dominated total tonnage, experiencing nearly a 40 percent increase from 1991-93 to 2001-03 while maintaining a relatively constant share of 1990-2003 tonnage. Recently released waterborne commerce statistics show that 2004 crude oil imports are 26 percent higher than in 2003.

Table 2
Texas City Channel Tonnage by Major Commodity Group (1000's of short tons)

	Major Deep-Draft Commodities					Major	Ocean-	
	Crude Oil	Petroleum Products		Chemical Products		Group	Going	Total
Year	Imports	Imports	Exports	Imports	Exports	Total	Total	Tonnage *
1990	25,184	480	1,166	320	618	27,768	34,003	48,071
1991	20,348	326	1,876	195	658	23,403	29,500	43,290
1992	26,435	448	1,181	249	1,101	29,414	29,778	43,104
1993	33,111	291	1,470	386	736	35,994	40,536	53,653
1994	22,863	445	274	275	537	24,394	30,068	44,351
1995	27,781	962	506	1,003	528	30,780	35,607	50,403
1996	31,901	500	1,365	429	890	35,085	41,208	56,394
1997	33,900	639	1,758	442	568	37,307	42,379	56,646
1998	27,958	237	1,633	265	1,149	31,242	37,134	49,477
1999	26,900	791	1,483	191	1,706	31,071	36,376	49,503
2000	34,646	1,519	2,871	519	1,533	41,088	47,797	61,586
2001	38,688	1,382	2,263	261	1,449	44,043	49,985	62,270
2002	32,864	2,326	1,540	451	1,127	38,308	43,524	55,233
2003	38,773	1,254	1,794	157	1,323	43,301	48,697	61,338
2004	48,845	3,175	3,082	189	1,281	50,572	55,509	68,283
	Compound Annual Growth (1990-03)							
	3.4%	7.7%	3.4%	-5.3%	6.0%	3.5%	2.8%	1.9%

* includes shallow-draft barge tonnage

Source: USACE, Waterborne Commerce of the U. S., Part 3, 1990-04

Since the 1970's, both Texas City and U.S. crude petroleum imports have steadily risen as U.S. crude production has fallen and been replaced by foreign imports of crude. The Energy Information Administration (EIA) in its Annual Energy Outlook (AEO) 2006 is projecting continuing declines in U.S. production over the 2004-30 forecast period, along with steady growth of imports. The EIA shows U.S. crude petroleum production declining from 5.42 million barrels per day 2004 to 4.57 million barrels day in 2030, with an average annual compound growth rate of -0.7 percent. Over the same period, Alaskan production is projected to decline by -4.5 percent annually.

5.3 CRUDE PETROLEUM AND ENERGY DEMAND INDICATORS

The U.S. Gulf Coast leads the nation in refinery capacity, with 41 percent of the Nations' crude oil distillation capacity. Products, such as gasoline, heating oil, diesel and jet fuel, are transported from the Gulf Coast to the East Coast and the Midwest. One-half of the Gulf Coast refinery capacity is in Texas and the remainder is in Louisiana. Texas City's refinery capacity represents 4.0 percent of the national total and nearly 16 percent of the State total (Table 3). Texas City's current capacity is 718,950 barrels per calendar day, up by approximately 15 percent since 1994.

Table 3
Texas City Atmospheric Crude Oil Distillation Capacity and Percentage of State and National Totals

	Texas City Refinery Capacity *		
Date	Barrels/day	% Texas Total	% U. S.
1-Jan-94	626,500	14.0%	4.2%
1-Jan-99	657,000	15.7%	4.0%
1-Jan-00	661,000	15.6%	4.0%
1-Jan-01	661,000	15.4%	4.0%
1-Jan-02	713,000	15.9%	4.2%
1-Jan-03	724,000	16.7%	4.3%
1-Jan-04	713,000	15.9%	4.2%
1-Jan-05	718,950	15.5%	4.2%

*Barrels per day capacity of 718,950 equals approximately 39,455,690 short tons. U. S. capacity was nearly 18 million barrels per day.
Source: U. S. Department of Energy, Energy Information Administration, extracted from detailed files.

The amount of crude petroleum imported into Texas City is dependent upon the area's capacity to refine crude and/or pipeline it to other refining complexes. Texas City 2001-03 crude petroleum import volumes are within 96 percent of crude petroleum refining capacity; however, approximately 15 percent of Texas City's crude imports are presently pipelined to Houston where additional existing throughput capacity exists.

Texas City refinery trends are similar to other U.S. refineries with declines in refinery capacity through the mid-1990's. The EIA notes that falling demand for petroleum and deregulation of the U.S. refining industry in the 1980s led to 13 years of decline in U.S. refinery capacity. The trend toward declining U.S. capacity was reversed to some extent in the mid-1990s, and 1.4 million barrels per day of distillation capacity was added between 1996 and 2003. Table 4 displays U.S. total annual crude petroleum refinery data for the period 1965-04.

Table 4
United States 1965-1999
Refinery Capacity and Utilization

Year	Number of Operating Refineries	Refinery Capacity Barrels/Day	Gross Input to Distillation Barrels/Day	Operable Refineries Utilization Rate
1965	293	10,419,851	9,535,395	91.5%
1970	276	12,021,273	11,491,018	95.6%
1975	279	14,960,710	12,873,296	86.0%
1980	319	17,988,121	13,802,736	76.7%
1985	223	15,658,769	12,137,936	77.5%
1990	205	15,571,966	13,579,314	87.2%
1991	202	15,675,627	13,477,804	86.0%
1992	199	15,696,155	13,607,175	86.7%
1993	187	15,120,630	13,820,256	91.4%
1994	179	15,034,160	14,000,343	93.1%
1995	175	15,434,280	14,087,230	91.3%
1996	170	15,333,450	14,344,353	93.5%
1997	164	15,451,785	14,804,822	95.8%
1998	163	15,711,000	15,079,207	96.0%
1999	159	16,261,290	15,052,213	92.6%
2000	158	16,511,871	15,312,512	92.6%
2001	155	16,595,371	15,340,367	92.6%
2002	153	16,785,391	15,138,719	90.7%
2003	149	16,757,000	15,508,000	92.6%
2004	149	16,974,000	15,783,000	93.0%
1980-1990 Average	249	16,406,285	13,173,329	80.5%
1991-1997 Average	182	15,392,298	14,020,283	91.1%
1998-2004 Average	155	16,513,703	15,316,288	92.9%

Source: U. S. Department of Energy, Energy Information Administration website data.

The EIA notes that financial and legal considerations make it unlikely that new refineries will be built in the United States; however, additions at existing refineries are on-going [2]. In spite of recognizable constraints, the EIA's most recent projections (AEO2006) show import levels increasing throughout the 2003-30 forecast period. At the same time, domestic distillation capacity is forecasted to increase by over 30 percent between 2003 and 2030. In comparison to the 1981 peak of 18.6 million barrels per day, distillation capacity is projected to grow from the 2003 year-end level of 16.8 million barrels per day to 22.3 million barrels per day in 2025 in the reference case and 21.4 million in the high oil price case. Almost all new capacity additions are projected to occur on the Gulf Coast. Existing refineries are expected to continue to be utilized intensively (92 to 95 percent of operable capacity) throughout the EIA forecast period. The 2003 utilization rate was 93 percent, well above the lows of 69 percent during the 1980s and even the 88 percent mark during the early 1990s but consistent with capacity utilization rates since the mid-1990s. EIA emphasizes that distillation capacity increases are expected due to

[2] Energy Information Administration, Annual Energy Outlook 2005, "Market Trends – Natural Gas Demand and Supply", p. 7.

improved processing of the intermediate streams obtained from crude distillation and subsequent reductions in residual fuel. Texas City industry personnel confirmed improved processing realizations and expect continued improvement.

The EIA expectation is that the market for residual is shrinking and the improved distillation processing will produce higher value "light products" such as gasoline, distillate, jet fuel, and liquefied petroleum gas. Texas City records for 2000-03 show residual fuel movements low in comparison to distillate. Texas City distillate import as well as exports and coastwise shipments have exhibited significant growth over the last decade. Foreign exports increased from 147,000 short tons over 1991-93 to 419,000 short tons over 2000-03 and imports grew from less than 100,000 short tons annually to over 800,000 in 2003. Deep-draft coastwise distillate shipments increased from 303,000 short tons over 1991-03 to 790,000 short tons over 2001-03 In spite of current and future increases, the EIA expects that world demand for "light products" will be supplemented by foreign markets, particularly in the Asia/Pacific region. Refinery construction in developing countries is noted to generally necessitate configurations that are more advanced than those currently in operation in the U.S. Additionally, foreign refineries will need to supply lighter products from crude oils whose quality is anticipated to deteriorate between 2003 and 2030.

While recognizing these trends and associated limitations, both EIA (December 2005) and Global Insight (2005) show imports increasing over the forecast periods. Additionally exports are projected to increase but a more modest rate. Both the EIA and Global Insights provide forecasts of product imports, product forecasts indicators are more general. The EIA is forecasting an average annual growth of 0.4 percent for 2004-30 U.S. product exports. In addition to potential uncertainty due to refinery capacity, the effect of price increases was investigated. An outcome of high oil prices and world stability concerns experienced throughout 2005 demonstrates obvious uncertainty inherent in forecasting crude oil markets. Crude oil prices in the AEO2006 reference forecast are substantially higher than the AEO2005 (January 2005) forecast and are also considerably higher than most other projections (Table 5). Despite EIA's forecast of higher crude oil prices, import volumes are surprisingly similar between forecasts. The AEO2006 release shows average annual growth rates of 0.6 percent for 2004-10 crude oil imports and 1.1 percent for 2010-30. In comparison to the AEO2005 and July 2005 mid-year forecast growth rates were 2.3 percent from 2003-10 and 2.4 percent from 2010-25.

Table 5
Comparison of AEO2006 and Alternative Forecasts
World Oil Price and U. S. Crude Oil Imports 2004, 2015 and 2030

		AEO2006			Alternative Forecasts				
		Reference Forecast	High Price	High Growth	Global Insights	Deutsche Bank	Energy Venture Analysis	PIRA Energy Group	Delphi Group
Component / Year	2004	2015	2015	2015	2015	2015	2015	2015	2015
World Oil Price a/	$31.52	$47.79	$76.30	$47.79	$34.06	$31.75	n/a	$49.95	$52.50
Imports Millions Barrels/Day	10.06	10.47	9.68	11.20	11.28	11.74	11.06	9.65	n/a
Component / Year	2004	2030	2030	2030	2030	2030	2030	2030	2030
World Oil Price a/	$31.52	$56.97	$95.71	$56.97	$34.50	$31.75	n/a	n/a	$72.50
Imports Millions Barrels/Day	10.06	13.51	11.26	14.98	13.01	n/a	15.51	11.24	n/a

a/ Reflects EIA redefined world oil price path to represent the average U. S. refiners' acquisition price of imported low-sulfur light crude oil. This transition was made after AEO2005 and before AEO2006

Source: EIA 2006 Annual Energy Outlook, Tables 20 and 24. Supplemented with data from Global Insight, Petroleum Supply/Demand Balance, Table 13, September 2005.

Uncertainty also relates to oil depletion. The EIA notes in its "Issues in Focus" discussion (January 2005), that while fossil fuels are, no doubt, subject to depletion, increased scarcity and subsequent higher prices, there are many resources that are not heavily exploited. Higher prices, and the inference of profit increases, can be expected to lead to the development of sites and technologies, including production from oil sands, ultra-heavy oils, gas-to-liquids technologies, coal-to-liquids technologies, bio-fuel ultra-heavy oils, gas-to-liquids technologies, coal-to-liquids technologies, bio-fuel technologies and shale oil. Non-conventional liquid production is noted as a potential buffer against high oil prices. The EIA's January 2005 crude oil import projections show non-conventional liquids production increasing from 1.8 million barrels per day in 2003 to 5.7 million barrels per day by 2025. Additionally, higher prices are noted as perhaps being more of a function of high demand and inadequate refinery capacity (which is argued as being the result of years of low oil prices, inadequate investment in infrastructure, and producers' fear of surpluses). Recent price increases and expectations of a long-term price plateau have boosted interest in investment; however, continuous price increases and unstable supplies could lead to long-term declines in demand and, henceforth, deter investment interest.

5.4 TEXAS CITY COMMODITY PROJECTIONS

Table 6 summarizes the commodity projections used for Texas City's base line benefit calculations. Texas City's ocean-going tonnage forecasts are based on application of the EIA 2006 Annual Energy Outlook and a regression equation incorporating 1975-03 Texas City and U.S. historical imports and applying the AEO2006 2003-30 projections. The regression equation used for crude oil import forecast is reflective of short term continuation of Texas City tonnage growing at a faster rate than the U.S. totals. While Texas City's historical crude petroleum imports have increased at a faster pace than the nation, Texas City's long-term growth expectations, particularly after 2030, are assumed to be more reflective of the EIA and Global Insight projected trendlines. The AEO2006 reference forecast was used for Texas City's crude petroleum and petroleum product import and exports. Texas City's petroleum product import and export forecasts are based on direct application of the AEO2006 growth rates using Texas City's 2001-03 average tons as a base. Texas City's domestic coastwise petroleum product shipment forecast was prepared based on extrapolation of recent historical trends with an average annual growth rate of 1.3 percent anticipated for 2010-60. Sensitivity analysis using alternative tonnage forecasts, and changes in the percentage of cargo expected to benefit from channel deepening, is discussed in the Economic Appendix.

Table 6
Texas City Projections for Commodity Groups Used for Benefit Calculations
Totals by Commodity Group (1,000's of short tons)

	Crude Petroleum	**Petroleum Products**		
Year	**Imports**	**Imports**	**Exports a/**	**Coastwise Shipments**
1999	26,900	791	692	3,687
2000	34,646	1,519	842	5,058
2001	38,688	1,382	1,056	4,590
2002	32,864	2,326	720	3,092
2003	38,773	1,254	910	3,963
2001-03	36,775	1,654	895	3,882
2010	43,680	2,186	966	4,304
2020	53,246	2,842	1,015	4,898
2030	64,351	3,379	1,055	5,573
2040	71,084	4,016	1,096	6,341
2050	78,520	4,775	1,138	7,215
2060	86,735	5,677	1,183	8,210
	Average Annual Tonnage Growth Rate (2001/03 to 2030)			
	2.0%	2.7%	0.6%	1.3%
	Average Annual Tonnage Growth Rate (2030-2060)			
	1.0%	1.7%	0.4%	1.3%
	Average Annual Tonnage Growth Rate (2001/03-2060)			
	1.1%	2.1%	0.5%	1.3%
	Crude Petroleum	**Petroleum Products**		
Year	**Imports**	**Imports**	**Exports a/**	**Coastwise Shipments**
2010	34,944	895	145	430
2020	42,597	1,164	152	980
2030	51,481	1,383	158	1,115
2040	56,867	1,644	164	1,268
2050	62,816	1,955	171	1,443
2060	69,388	2,324	177	1,642

a/ Excludes petroleum coke. Petroleum coke is exported from an area not in the 45-foot reach.

Source: U. S. Department of Energy, Energy Information Administration, 2006 Annual Energy Outlook, December 2005 application.

5.5 PETROLEUM VESSEL FLEET EXPECTATIONS AND PROJECT BENEFICIARIES

Texas City's existing 40-foot project depth was designed to efficiently and safely accommodate vessels of approximately 40,000 DWT with loaded drafts of 36 feet. Since construction of the existing 40-foot project in 1967, the size and draft of vessels have increased to meet the competitive demand for more efficient movements of bulk commodities, in particular crude petroleum and petroleum products. Examination of the vessel sizes used in the transport of crude petroleum and, to a lesser extent, petroleum products revealed that significant transportation savings could be realized from larger vessel loads. Project benefits calculations were made for crude petroleum imports, petroleum product imports and exports, and coastwise movements of petroleum products transported through to docks adjacent to the Texas City Turning Basin [3]. The turning basin section of the Texas City Channel contains six docks that can receive crude petroleum, four of which can accommodate tankers in excess of 150,000 DWT. These docks receive all of Texas City's crude petroleum import tonnage and draft-constrained product tankers. Initial investigations suggested that a significant percentage of Texas City crude petroleum imports would immediately benefit from the 45-foot depth. Additionally, examination of the vessel sizes used for petroleum product imports and loading patterns at other Gulf Coast ports showed that up to 51 percent of product imports are transported in vessels with loaded drafts over 40 feet. Examination of Texas City's domestic coastwise petroleum product movements revealed that between 10 and 20 percent of domestic coastwise petroleum product tonnage would also likely utilize the Texas City 45-foot depth. Expectations concerning the relationship between the proposed 45-foot project depths and the percentage of tonnage transitioning to more fully loaded drafts are, no doubt, subject to a certain degree of uncertainty. Some of the major variables affecting utilization are origin of shipment and trade route. Other variables, particularly relevant in the short-term, include vessel availability and vessel operating costs. Minimization of vessel operating costs is, of course, assumed to drive long-term vessel choices.

5.6 REDUCTION IN TRANSPORTATION COST BENEFITS

The transportation costs and the savings associated with the proposed project depth increase were calculated using commodity-specific vessel class and trade route distributions. Port depth, trade route, and historical vessel utilization data were used to identify the percentage of tonnage anticipated to benefit from the Texas City proposed depth increases. Transportation costs were calculated based on the channel depth alternatives and variables associated with vessel design drafts, maximum feet of light-loading, underkeel clearance, mileage traveled, and the number of hours to load and unload.

[3] The issuance of the Shoal Point Container Terminal permit in 2004 and initiation of construction in 2005 will result in the introduction of containerships before the year 2010; however, the introduction of containerships with loaded drafts over 40 feet is not expected to affect plan optimization. The largest concentration of maximum loads for containerships is expected to be near 40 feet.

Table 7 displays the vessel operating costs used for the transportation cost calculations. Foreign flag tankers were used to calculate the transportation costs for foreign imports of crude petroleum and petroleum product imports and exports. U.S. flag tanker costs were used for coastwise product shipments.

Table 7
Tanker Vessel Characteristics and Hourly Operating Cost
FY 2005 Double Hull Tankers (As Presented in EGM 05-01)

Vessel DWT	Design Draft (feet)	Immersion Factor	Length (feet)	Beam (feet)	Hourly Tanker Cost Foreign-Flag At Sea	Foreign-Flag In Port	U. S. Flag At Sea	U. S. Flag In Port
20,000	29.9	78.7	497.7	79.5	$617	$475	$1,413	$1,271
25,000	32.0	90.8	531.1	85.4	$639	$490	$1,457	$1,308
35,000	35.4	112.6	585.8	95.1	$682	$520	$1,545	$1,383
50,000	39.5	141.4	649.9	106.7	$752	$570	$1,681	$1,499
60,000	41.8	158.9	685.3	113.1	$795	$600	$1,768	$1,573
70,000	43.8	175.4	716.8	118.8	$838	$630	$1,855	$1,648
80,000	45.6	191.0	745.2	124.1	$880	$660	$1,942	$1,722
90,000	47.3	205.9	771.2	128.8	$919	$687	$2,008	$1,775
120,000	51.6	247.5	838.5	141.3	$1,019	$749	$2,198	$1,928
150,000	55.2	285.4	894.8	151.8	$1,127	$820	$2,400	$2,669
175,000	57.9	315.0	935.9	159.5	$1,225	$888	$2586	$2,248
200,000	60.3	343.0	973.0	166.5	$1,318	$951	$2,766	$2,399
265,000	65.7	410.7	1,056.0	182.3	$1,555	$1,111	$3,214	$2,770
325,000	69.9	467.9	1,120.7	194.6	$1,715	$1,201	n/a	n/a

Compiled from USACE, Economic Guidance Memorandum, 05-01, October 2004.

The basic procedure used to calculate transportation costs (using a 90,000-DWT foreign flag tanker as an example) is illustrated in Table 8. Similar computations were made for appropriate distances and vessel sizes for each of the channel depth alternatives. The resulting costs per ton computations were calculated over the relevant range of vessels projected for each channel depth improvement, and the associated savings per ton were measured using the net differences in costs between the existing 40-foot channel and the depth alternative.

Table 8
Transportation Cost Calculation
Mexico to Texas City

Vessel Characteristics and Cost Inputs	
Vessel DWT	90,000
Design Draft (ft.):	47.3
Cargo Capacity: DWT * 95%	85,500
Immersion Factor (tons per inch) a/	205.9
Hourly Cost at Sea:	$919.0
Underkeel Clearance (ft) a/	3
Hourly Cost in Port:	$687.0
Loading/Unloading Rate (tons/hour)	5,250
Round Trip Mileage	1400
Speed (Knots):	15
Cost for Voyage: (mileage/speed)*(hourly vessel cost)	$85,773
Maximum Load on 40 Foot Channel b/	60,051
Hours to Load and Unload above short tons:	22.6
Voyage Cost/Ton for 40-ft. Channel	$1.43
Loading & Unloading Cost/Ton for 40-ft. Channel	$15,716
Cost/Ton for Loading and Unloading for 40-ft. Channel	$0.26
Total Cost Per Ton on 40-ft. Channel	$1.69
Maximum Load on 45 Foot Channel b/	72,405
Voyage Cost/Ton for 45-ft Channel	$1.18
Loading & Unloading Cost/Ton for 45-ft Channel:	$0.26
Total Cost Per Ton on 45 -ft. Channel	$1.45
Per Ton Savings Between 45- and 40-foot Channel	$.24

a/ Discussion of these variables are presented in the Economic Appendix.
b/ ((DWT * Maximum % Load)-(Immersion Factor * 12 * number feet light-loaded)

5.7 CRUDE PETROLEUM IMPORTS TRANSPORTATION SAVINGS BENEFITS

Transportation savings benefits from reductions in the vessel operating costs were calculated based on the relative difference in transportation costs between the without-project and with-project conditions. Transportation costs and savings were calculated for vessels that minimize transportation costs given trade route constraints. As previously noted, long-term fleet selection will continue to reflect goals of minimizing vessel operating costs. Table 9 summarizes the transportation costs by trade route used to calculate the with and without- project future conditions. The per ton transportation costs correspond to the least cost method of shipment associated with the particular trade route.

TABLE 9
Texas City Crude Petroleum Imports
Transportation Cost and Savings, Most Likely Transportation Mode
Trade Route and Channel Depth

Trade Route/Depth	40 ft.	43 ft.	44 ft.	45 ft.	48 ft.	50 ft.
Mexico	Direct	Direct	Direct	Direct	Direct	Direct
cost/ton	$1.73	$1.57	$1.53	$1.49	$1.40	$1.36
savings/ton		$0.16	$0.20	$0.24	$0.33	$0.37
Venezuela & Trinidad	Direct	Direct	Direct	Direct	Direct	Direct
cost/ton	$3.74	$3.36	$3.26	$3.17	$2.95	$2.89
savings/ton		$0.38	$0.47	$0.57	$0.78	$0.85
W. Africa and North Sea	Lighten	Lighten	Lighten	Lighten	Direct	Direct
cost/ton	$8.52	$8.44	$8.41	$8.39	$8.20	$7.74
savings/ton		$0.08	$0.11	$0.13	$0.32	$0.77
Middle East	Lighter	Lighter	Lighter	Lighter	Lighter	Lighter
cost/ton	$11.41	$11.40	$11.20	$11.17	$11.15	$11.15
Savings/ton		$0.01	$0.21	$0.24	$0.26	$0.26

Review of the depths at trading ports and significant savings per ton indicate that nearly all crude petroleum from Mexico, Venezuela and Trinidad would utilize 45 feet. An increase in Texas City's channel depth allows the existing range of 90,000 to 120,000 DWT vessels to carry approximately 20 percent more cargo, and the channel depths at the ports-of-origin are equipped to facilitate this transition. Expectations concerning the percentage of Middle East and Africa movements are subject to greater uncertainty. Nearly all Middle East tonnage is lightered and nearly all West Africa crude is lightened. The logistics associated with these offshore transfers introduces higher degrees of uncertainty than with direct shipment. However, as the Table 9 presentation illustrates distinct cost savings are apparent.

The savings for lightering movements results from increases in shuttle loads due to greater channel depth in Texas City. For lightering, the effect of increasing channel depths at Texas City allows for the reduction in the number of shuttles necessary to totally lighter a Very Large Crew Carrier. The savings for lightened movements results from decreases in offshore unloading time from the mother vessel to shuttles. For lightening, the mother vessel is substituting offshore unloading time for dock-side unloading time. Additionally, the shuttle vessel reduces its overall loading and unloading time. Lightening generates comparatively lower savings than lightering because the latter produces the possibility of reducing the number of shuttles needed.

Table 10
Texas City Percentage of Crude Petroleum Import Tonnage by Vessel DWT Class
Existing Conditions (2001/04) and Future (2010-60)

	Direct Shipments						Lightering	
	Mexico		South America		Europe/Africa/Med		Shuttle Vessels	
DWT	Existing	Future	Existing	Future	Existing	Future	Existing	Future
60000	5.0%	0.0%	8.0%	0.0%	0.0%	0.0%	0.8%	0.0%
80000	6.0%	5.0%	10.0%	10.0%	0.0%	0.0%	3.7%	4.5%
90000	22.0%	24.5%	12.0%	14.5%	0.0%	0.0%	27.4%	27.4%
100000	14.0%	17.4%	68.0%	70.5%	0.0%	0.0%	22.0%	22.0%
110000	47.3%	47.3%	0.0%	5.0%	0.0%	0.0%	38.6%	38.6%
120000	0.1%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
135000	0.1%	0.1%	0.0%	0.0%	0.0%	0.0%	0.8%	0.8%
>=150000	5.6%	5.6%	2.0%	0.0%	100.0%	100.0%	6.7%	6.7%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Table 10 displays comparison of the percentage distribution of crude petroleum tonnage by trade route for the existing 40-foot project depth and the project future defined by channel deepening. The shift to larger vessels is generally anticipated to take place under both the without- and with project future conditions. Table 11 summarizes the annual transportation cost savings by channel depth. Again, the transportation cost savings were calculated based on the least cost shipping methods displayed in Table 9.

5.8 PETROLEUM PRODUCT TRANSPORTATION SAVINGS BENEFITS

Reductions in the vessel operating costs for Texas City's foreign petroleum product imports, exports and coastwise shipments were calculated based on the relative difference in transportation costs between the without-project and with-project conditions. As with crude petroleum, transportation costs and savings were calculated for vessels that minimize transportation costs given trade route constraints. Again, long-term fleet selection will continue to reflect goals of minimizing vessel operating costs.

Table 11
Texas City Crude Petroleum Imports
Annual Transportation Savings ($1,000's) by Trade Route and Decade
Channel Depth Alternative, Year, and Representative Origin

43-foot Channel	2000-03	2010	2020	2030	2040	2050	2060
Mexico	$1,493	$1,427	$1,679	$1,958	$2,183	$2,412	$2,664
Central/South America	$3,500	$3,988	$4,777	$5,713	$6,371	$7,038	$7,774
W. Africa & North Sea	$642	$999	$1,307	$1,612	$1,798	$1,986	$2,193
Middle East	$60	$72	$87	$106	$118	$131	$144
Total Savings	$5,695	$6,486	$7,850	$9,389	$10,471	$11,566	$12,776
44-foot Channel	2000-02	2010	2020	2030	2040	2050	2060
Mexico	$1,907	$1,823	$2,145	$2,501	$2,789	$3,081	$3,403
Central/South America	$4,417	$5,032	$6,028	$7,210	$8,040	$8,882	$9,811
W. Africa & North Sea	$736	$1,145	$1,499	$1,847	$2,060	$2,276	$2,514
Middle East	$2,396	$2,864	$3,436	$4,209	$4,694	$5,185	$5,728
Total Savings	$9,456	$10,864	$13,108	$15,767	$17,584	$19,424	$21,456
45-foot Channel	2000-02	2010	2020	2030	2040	2050	2060
Mexico	$2,289	$2,189	$2,575	$3,003	$3,349	$3,699	$4,086
Central/South America	$5,268	$6,002	$7,190	$8,599	$9,590	$10,594	$11,702
W. Africa & North Sea	$811	$1,261	$1,651	$2,035	$2,270	$2,507	$2,769
Middle East	$2,827	$3,379	$4,054	$4,965	$5,538	$6,117	$6,757
Total Savings	$11,196	$12,831	$15,470	$18,603	$20,747	$22,917	$25,315
48-foot Channel	2000-02	2010	2020	2030	2040	2050	2060
Mexico	$3,159	$3,020	$3,554	$4,144	$4,622	$5,105	$5,639
Central/South America	$7,305	$8,322	$9,969	$11,923	$13,297	$14,688	$16,225
Europe & Africa	$1,984	$3,086	$4,039	$4,979	$5,553	$6,134	$6,776
Middle East	$3,060	$3,657	$4,388	$5,374	$5,994	$6,621	$7,314
Total Savings	$15,508	$18,085	$21,950	$26,421	$29,466	$32,548	$35,954
50-foot Channel	2000-02	2010	2020	2030	2040	2050	2060
Mexico	$3,536	$3,381	$3,977	$4,638	$5,714	$5,714	$6,312
Central/South America	$7,888	$8,987	$10,766	$12,876	$14,360	$15,862	$17,522
Europe & Africa	$4,818	$7,494	$9,809	$12,093	$13,486	$14,897	$16,456
Middle East	$3,060	$3,657	$4,388	$5,374	$5,994	$6,621	$7,314
Total Savings	$19,302	$23,519	$28,940	$34,981	$39,554	$43,094	$47,603

Table 12 summaries the annual transportation savings benefits for petroleum product imports and exports. Examination of Texas City's 2000-03 product imports and exports revealed significant potential for transportation savings from loading product carriers to increased drafts. Examination of trade route constraints, parcel sizes, and discussion with shipping industry representatives suggested that 38 percent of imports and 14 percent of exports would benefit from depths between 41 and 45 feet. Table 13 displays Texas City's 2000-03 product tonnage by vessel size. While the presentation indicates that nearly 80 percent of imports and over 60 percent of exports are associated with design drafts in excess of 40 feet, some tonnage faces port draft-restrictions, including the Panama Canal and are not presently loaded to drafts over 35 feet.

Table 12
Texas City Petroleum Product Imports and Exports
Annual Transportation Savings ($1,000)
byTrade Route and Decade

Trade Route and Year	2001-03	2010	2020	2030	2040	2050	2060
Europe and Africa (65%)	**43-foot Channel Imports Transportation Cost**						
Latin America (35%)	$683	$915	$1,198	$1,363	$1,550	$1,763	$2,005
	43-foot Channel Exports Transportation Cost						
(75% Europe/25% Brazil)	$146	$158	$166	$173	$179	$186	$193
Total Savings	$830	$1,073	$1,364	$1,535	$1,729	$1,949	$2,199
Europe and Africa (65%)	**44-foot Channel Imports Transportation Cost**						
Latin America (35%)	$894	$1,195	$1,563	$1,778	$2,023	$2,302	$2,619
	44-foot Channel Exports Transportation Cost						
(75% Europe/25% Brazil)	$187	$202	$212	$221	$229	$238	$247
Total Savings	$1,081	$1,397	$1,775	$1,999	$2,252	$2,540	$2,867
Europe and Africa (65%)	**45-foot Channel Imports Transportation Cost**						
Latin America (35%)	$1,077	$1,440	$1,884	$2,143	$2,438	$2,774	$3,156
	45-foot Channel Exports Transportation Cost						
(75% Europe/25% Brazil)	$225	$243	$256	$266	$276	$287	$298
Total Savings	$1,302	$1,683	$2,139	$2,409	$2,714	$3,061	$3,454
Europe and Africa (65%)	**48-foot Channel Imports Transportation Cost**						
Latin America (35%)	$1,563	$2,090	$2,735	$3,111	$3,540	$4,027	$4,582
	48-foot Channel Exports Transportation Cost						
(75% Europe/25% Brazil)	$324	$350	$368	$382	$397	$412	$428
Total Savings	$1,887	$2,440	$3,102	$3,493	$3,936	$4,439	$5,010
Europe and Africa (65%)	**50-foot Channel Imports Transportation Cost**						
Latin America (35%)	$1,563	$2,090	$2,735	$3,111	$3,540	$4,027	$4,582
	50-foot Channel Exports Transportation Cost						
(75% Europe/25% Brazil)	$324	$350	$368	$382	$397	$412	$428
Total Savings	$1,887	$2,440	$3,102	$3,493	$3,936	$4,439	$5,010

Table 13
Texas City Petroleum Product, 2000-2003
Percentage of Imports and Exports by Vessel DWT

DWT Range	Design Draft (ft)	2000	2001	2002	2003	Average
Texas City Petroleum Product Imports						
Less than 47,999	37	23.3%	20.9%	19.2%	24.2%	21.9%
47,999 to 59,999	42	21.1%	6.5%	4.0%	0.0%	7.9%
60,000 to 69999	44	42.8%	43.7%	33.1%	43.9%	40.9%
70,000 to 79,999	46	0.8%	4.9%	5.4%	24.8%	9.0%
80,000 to 89,999	42	1.4%	5.1%	7.0%	4.8%	4.6%
90,000 to 99,999	47	3.9%	6.5%	11.1%	0.0%	5.4%
100,000 to 119,999	49	6.7%	12.5%	20.3%	2.2%	10.4%
120,000 to 125,999	n/a	0.0%	0.0%	0.0%	0.0%	0.0%
126,000 to 138,999	n/a	0.0%	0.0%	0.0%	0.0%	0.0%
Total		100.0%	100.1%	100.1%	100.0%	100.0%
Texas City Petroleum Product Exports a/						
Less than 47,999	38	41.1%	42.3%	80.3%	81.1%	61.2%
47,999 to 59,999	43	28.3%	8.3%	0.0%	0.0%	9.2%
60,000 to 69999	43	20.6%	15.3%	7.7%	10.1%	13.4%
70,000 to 79,999	n/a	0.0%	0.0%	0.0%	0.0%	0.0%
80,000 to 89,999	48	6.0%	8.6%	0.0%	0.0%	3.7%
90,000 to 99,999	45	4.0%	7.6%	12.0%	8.7%	8.1%
100,000 to 119,999	47	0.0%	17.9%	0.0%	0.0%	4.5%
120,000 to 125,999	n/a	0.0%	0.0%	0.0%	0.0%	0.0%
126,000 to 138,999	n/a	0.0%	0.0%	0.0%	0.0%	0.0%
Total		100.0%	100.0%	100.0%	100.0%	100.0%

Source: Compiled from U. S. Army Corps of Engineers, Navigation Data Center detailed records.
a/ Excludes Petroleum Coke.

Table 14 summarizes the benefit calculations for coastwise product shipments. Examination of Texas City's 2001-03 coastwise petroleum product vessels showed that approximately 10 percent of outbound coastwise shipments were transported in draft restricted tankers. The largest product carriers generally are between the 60,000 and 80,000 DWT and the design drafts in the 41 to 43-foot range. Additionally, 35.9 percent of 2001-03 coastwise products were transported in vessels with loaded drafts over 36 feet. The vessels used are all U. S. flag vessels, Jones' Act vessels. The median age of the current fleet exceeds 10 years, with most vessels built in the mid-nineteen eighties. It is expected that the eventual replacement fleet will generate a higher concentration of slightly larger vessels. Additionally, it is expected that the design drafts for new vessel orders will in the 40- to 43-foot range. Review of "vessels on order records" for U.S. tankers showed several new orders for vessels in the 60,000 to 80,000 DWT range. The majority of the current draft-constrained tankers were outbound movements of gasoline from Texas City to Port Everglades, Florida. Port Everglades has a channel depth of 42 feet and more fully loaded vessels could be accommodated. In addition to Port Everglades, there are several other U. S. East Coast ports at depths between 42 and 45 feet, with New York Harbor presently authorized to 50 feet. General indicators associated with U. S. port depth trends and eventual vessel replacement expectations suggest that 10 percent of Texas City coastwise tonnage would utilize loaded depths of 42 feet by the year 2010 given channel depth availability in Texas City.

It is not unreasonable to assume that the expected 10 percent estimate would increase to 20 percent by year 2020.

Table 14
Petroleum Product Coastwise Shipments
Vessel Data, Base Tonnage, and Transportation Savings Benefit Summary

Origin-Destination Data

Shipments to Pt Everglades from Texas City	
Initial % of total outbound shipments:	10.0%
Round trip mileage:	2,450

Vessel Input Data and Transportation Cost

Channel Depth (ft)	Design Draft (ft)	Vessel DWT	No. of feet Light-Loaded	Cargo by Channel Depth	Round Trip Voyage Cost	Loading and Unloading Cost	Tug Cost	Total Cost	Cost Per Ton
40	43	45000	6	30,871	$272,541	$16,947	$7,319	$296,807	$9.61
45	43	45000	2	37,890	$272,541	$20,800	$7,422	$300,763	$7.94
					Saving/ton				$1.68

Texas City Domestic Coastwise Petroleum Product Annual Transportation Benefits

Year	Total Tonnage	Used for Benefits	Percentage Used for Benefits	Annual Savings
2001/03	3,881,607	388,161	10%	$650,858
2010	4,304,147	430,415	10%	$721,709
2020	4,897,580	979,516	20%	$821,214
2030	5,572,833	1,114,567	20%	$934,439
2040	6,341,186	1,268,237	20%	$1,063,274
2050	7,215,475	1,443,095	20%	$1,209,873
2060	8,210,307	1,642,061	20%	$1,376,684

5.9 SUMMARY

Texas City's historic traffic was initially evaluated to identify the percentage of tonnage currently or anticipated to be limited by the constraints of the existing and the without-project future channel dimensions. Within the context of this framework, channel constraints were defined to exist when a percentage of the tonnage associated with a commodity group is currently or anticipated to be transported in vessels that cannot be fully loaded. The historic data clearly showed that a significant share of the vessels used in the transport of crude petroleum could be loaded to depths over 40 feet. In addition, but to a lesser extent, examination of the 1998-03 vessels sizes, loaded drafts, design drafts, and parcel sizes revealed that vessels used to transport petroleum products are constrained by the existing 40-foot channel depth. A more detailed discussion of Texas City's long-term historical trends and evaluation of forecast indicator are contained in the Economic Appendix.

Table 15 summarizes the annual transportation saving benefits by channel depth alternative.

Table 15
Transportation Savings ($1000) by Channel Depth and Commodity Group

		Crude Petroleum Imports			
		Transportation Savings by Channel Depth 2010-2060			
Year	43	44	45	48	50
2010	$6,486	$10,864	$12,831	$18,085	$23,519
2020	$7,850	$13,108	$15,470	$21,950	$28,940
2030	$9,389	$15,767	$18,603	$26,421	$34,981
2040	$10,471	$17,584	$20,747	$29,466	$39,554
2050	$11,566	$19,424	$22,917	$32,548	$43,094
2060	$12,776	$21,456	$25,315	$35,954	$47,603
		Average Annual Benefits (50-Year Project Life at 4.875%)			
2010-60	$8,571	$14,362	$16,950	$24,032	$31,743
		Petroleum Product Import and Export Tonnage (Includes Coastwise Domestic)			
		Transportation Savings by Channel Depth 2010-2060			
Year	43	44	45	48	50
2010	$1,795	$2,119	$2,405	$3,162	$3,587
2020	$3,006	$3,418	$3,782	$4,745	$5,286
2030	$3,404	$3,868	$4,278	$5,362	$5,972
2040	$3,856	$4,379	$4,841	$6,063	$6,750
2050	$4,369	$4,960	$5,480	$6,859	$7,634
2060	$4,952	$5,620	$6,207	$7,763	$8,638
		Average Annual Benefits (50-Year Project Life at 4.875%)			
2010-60	$3,052	$3,487	$3,872	$4,889	$5,461
		Total Average Annual Benefits (50-Year Project Life at 4.875%)			
Total	$11,623	$17,849	$20,822	$28,921	$37,203

The purpose of the analyses was to determine if the net excess benefits from deepening the existing 40-foot channel to 45 feet exceeded those for channel depth alternatives less than 45 feet. Benefits were calculated for channel depth alternatives of 43, 44, 45, and 48 feet. The 43-foot depth was evaluated to help determine if net excess benefits maximized at a depth less than 44 or 45 feet and to determine the change in transportation costs at the 1-foot increment. The 48-foot depth was included to determine the magnitude of increased savings at depths over 45 feet.

The results of the preliminary analysis showed that economies of scale realized from larger cargo loads generated higher benefits at deeper channel depths.
Table 16 compares the benefits and costs of the various alternatives, as well as the authorized 50-foot project.

Table 16
Comparison of Alternatives

Discount Rate 4.875%					

Cost in $1,000					
Depth in Feet	**43**	**44**	**45**	**48**	**50**
Estimated First Cost of Construction	$34,219	$42,446	$52,652	$107,087	$145,065
Months to Construct	24	24	24	48	60
Interest During Construction	$1,647	$2,043	$2,535	$10,890	$18,833
Non-Federal Associated Cost	$2,133	$2,346	$2,581	$2,839	$3,123
Total Project Construction Cost	$39,107	$47,943	$58,876	$121,924	$168,129
Archaeology Mitigation Cost	$1,108	$1,108	$1,108	$1,108	$1,108
Average Annual Construction Cost	$2,101	$2,576	$3,163	$6,550	$9,032
Average Annual O&M	$139	$139	$139	$2,000	$4,000
Total Average Annual Cost	$2,240	$2,715	$3,302	$8,550	$13,032
Average Annual Benefits	$11,623	$17,849	$20,822	$28,921	$37,203
Net Excess Benefits	$9,383	$15,134	$17,520	$20,371	$24,171
B/C Ratio	5.2	6.6	6.3	3.4	2.9

6.0 ENGINEERING STUDIES

6.1 HYDRODYNAMIC STUDY

Astronomical tide induced currents, wind induced circulation density related currents and freshwater inflow are major factors that would influence salinity and circulation in the bay. The experimental conditions used for hydrodynamic study were created for the Houston-Galveston Navigation Channels hydrodynamic study by Berger et al.1995. Tides in Galveston Bay are predominantly diurnal; the mean tide range is about 1.6 feet at the entrance of the bay, decreasing to 1.00 foot or less near Baytown. A hydrodynamic model study was performed to obtain currents for the existing and with project conditions.

The ebb for the improved condition showed a slight increase in current speed within the channel near the added berthing area but a slight decrease in the currents in the berthing area. For the flood conditions the greatest difference occurred when the turning basin and berthing areas were added. The approach to the Texas City Channel in Bolivar Roads showed a slight increase in current speed.

The primary goal of this study was to provide currents for the ship simulator for maximum flood and ebb for both the existing and project conditions. The verification was performed to ensure the model was behaving in the same manner as for the previous study. It was found that changes did not have a major effect on the maximum velocities at either the maximum flood or ebb condition.

6.2 SHIP SIMULATION

To properly evaluate the two screened alternative depths, 44 feet and 45 feet, with possible incidental widening options, a ship simulation study was conducted by USACE’s Engineering Research and Development Center (ERDC). The purpose of the ship simulation was to determine navigation and safety impacts due to anticipated changes in vessel sizes as a result of any proposed channel widening. The study was to determine whether the “design” ship could safely operate within the width and depth of the proposed channel dimensions. Simulation was also used to select channel widths based on a multiple of beam dimensions. The simulation was conducted on a channel depth of 45 feet with a 400-foot width.

Vessels used in the simulation, three tankers and a container ship, ranged from 895 to 1,140 feet in length; 140- to 156-foot beam widths; and 27- to 44-foot drafts. The vessels were selected based on discussion with the Non-Federal Sponsor and the Pilots’ Association. The simulation was validated with the assistance of licensed pilots for the Texas City Channel. The channel was defined using bank conditions, currents, visual scene and radar image of the study area, location of all aids to navigation, location and orientation of existing docks, location of buildings visible from the vessel, and the location of the planned Shoal Point Terminal, including the location of the new berthing area and the turning basin. To validate the reaction of the vessel to bank forces, several simulation runs were made with the vessel transiting the entire study area. Several simulation runs were made using the existing and alternative channel configurations. The wind speed ranging from 0 to 25 knots and current speed from 0 to 14 knots in different combination were used for the runs and pilots' responses were noted. The simulation of the vessels did not indicate any major problem with the channel design.

The tankers were observed to have encountered some problem in negotiating the curve at channel Station 20+500. The simulation runs show that while the vessel is already out of the effect of most of the current in the channel, a wind from the south will force the pilot to compensate and end up close to the south edge of the channel. For this reason, the curve is recommended to be widened by at least 50 feet.

7.0 PLAN SELECTION

7.1 OVERVIEW

Based on the economic, engineering and environmental factors considered, the selected plan includes deepening the Texas City Turning Basin and Texas City Channel from the Turning Basin to the channel junction with the HSC to -45-feet MLT. A total of approximately 4.8 million cubic yards (mcy) of construction and maintenance grade material would require separate dredging contracts to complete. The work is estimated to begin in 2008 and be complete by 2010. Dredged material management will be performed according to the Dredged Material Management Plan (DMMP) described in Section 7.3.

7.2 GENERAL NAVIGATION FEATURES OF THE SELECTED PLAN

Texas City Turning Basin and Industrial Canal

The Industrial Canal is 250 feet wide by 1.7 miles long and is authorized to - 40 feet. The Industrial Canal will not be improved at this time. The Turning Basin is 1,000 feet wide by 1,150 feet long and will be deepened to -45 feet with two foot advanced maintenance and 1 foot allowable over depth. Approximately 0.9 mcy of construction and maintenance grade material will be dredged from the turning basin.

Texas City Channel

The channel from the Texas City Turning Basin to Bolivar Roads (Station 1+493 to Station 37+429.99) is 400 feet wide by 6.75 miles long and will be deepened to -45 feet with the currently approved practice of an additional three foot advance maintenance and two foot allowable over depth. Incidental widening for easing a bend and making the channel more linear is necessary between Station 19+339.69 to Station 21+716.78 based on the results of ERDC's Ship Simulation Report. This will allow pilots to have an easier time navigating the bend in this area of the channel. Approximately 4.8 mcy of construction and maintenance grade (quality of maintenance material, but is new work material) material will be removed from the channel.

Texas City Dike

The Texas City Dike is an integral feature of the navigation channel in that it shelters the channel from northerly wind waves and currents. Not only does the dike calm the water from these waves and currents, thereby facilitating safe navigation, it abates shoaling of the channel from the north. Areas along the north side of the dike also serve as PAs for sandy maintenance material. Two PAs currently exist and a third will be utilized for this project. The placement plan is described in the DMMP in Section 7.3. Two secondary hydraulic-fill finger groins are planned for the north side of the dike near its eastern tip to retain maintenance material when it is placed behind the groins. The groins should reduce the transport of sediments back into the channel.

Dredged Material PAs

The Shoal Point PA (SPPA) is the only confined (leveed) upland PA used for maintaining the Texas City Channel. This PA was originally about 700 acres in size, but has since (in 2005) been scaled down and reconfigured into two relatively small-sized PAs that are adjacent to each other – PA 5 and PA 6, separated by an access road corridor (Figure 4). PA 5 is approximately 126 acres in size. PA 6 is approximately 75 acres. The former 700-acre PA provided about half the storage capacity needs for channel maintenance; the other half being the areas along the north side of the Texas City Dike (PAs 2A and 2B).

Six placement areas would be constructed adjacent to or just offshore of the southeast side of the existing SPPA. These include SPPAs 1, 1A, 2, 3, 4 and 5. SPPAs 1 and 1A will be constructed by the City of Texas City in fulfillment of their USACE Permit requirements. SPPAs 2, 3, 4 and 5 will be constructed as part of the Federally funded channel deepening project and would eventually be converted to emergent marsh. The Pelican Island PA, would be constructed adjacent to the western side of Pelican Island and would be constructed during one dredging cycle. New work material will be utilized for levee construction for the PAs in open water. The PAs would then be filled with maintenance material over time and would eventually be converted to emergent marsh. All PAs are summarized in Table 17.

Table 17
Placement Area Summary

Placement Area	Type/Location	Size (acres)
PA5	Existing upland site/on Shoal Point	126
PA6	“	75
SPPA 1*	New open water site/adjacent to Shoal Point	357
SPPA 1A*	“	
SPPA 2	“	156
SPPA 3	“	
SPPA 4	“	469
SPPA 5	“	
Pelican Island PA	New open water site/adjacent to Pelican Island	104
PA 2A	Existing open water site/north side of TX City Dike	75
PA 2B	“	75
PA 2C	New open water site/north side of TX City Dike	75

* to be constructed by the Non-Federal Sponsor

7.3 DREDGED MATERIAL MANAGEMENT PLAN (DMMP)

The decision was made at the start of the reevaluation process to utilize the DMMP that was developed during the EIS for the Shoal Point Container Terminal USACE permit. The DMMP was thoroughly coordinated with local resource agencies, industry groups, the general public, and the civil works side of USACE Galveston District. The plan was ultimately approved by the EPA and Texas State agencies that have authority over Section 401 of the Clean Water Act and coastal zone management issues. It was determined that the size and locations of the placement cells were the most environmentally and logistically sound for material dredged from the Texas City Channel. The creation of upland PAs in open bay waters was not considered to be environmentally acceptable. The PAs were sized, shaped and located so that environmentally sensitive areas were avoided (primarily oyster beds). The plan ultimately includes the conversion of the placement cells to emergent marsh, therefore utilizing the dredged material beneficially.

During this reevaluation, the DMMP was evaluated according to USACE requirements regarding costs, required capacity for dredged material for the project, and engineering requirements. It also included a reevaluation of potential upland sites for placement of material. Most surrounding upland areas are developed as commercial properties. Three small non-contiguous tracts were located. However, the pump distance to those sites is approximately 10 miles. Pumping 4.8 mcy of new work material over a distance of 10 miles at a cost of $12.00 per cy is approximately $57.6 million. Pumping 43.6 mcy of maintenance material at $6.00 per cy would be approximately $304 million. These costs do not include real estate costs to secure the land and costs to prepare the uplands to receive dredged material. The closest large tract of land (Virginia Point) contains wetlands and was recently purchased as a wetland preserve.

The only other option for placement of material would be offshore disposal with a cost estimate of $98 million for transporting the new work material offshore and $626 million over the 50 year period of analysis for the transportation of maintenance material to an offshore location.

Both upland and offshore placement are cost prohibitive. The DMMP that was approved in the USACE permit, with some minor modifications, is the base plan for the current Federal project reevaluation study.

Minor modifications to the DMMP that were approved in the USACE permit have been made. The footprint for the placement of material will remain the same, except for the additional PA north of the Texas City Dike. The modifications primarily include the sequencing of the placement of material. The most prominent sequencing change is that the construction of the levees for BUS1 (re-named SPPA1 and 1A) that are the responsibility of the City will be completed in two phases. The levees of SPPA2 will be constructed as part of the Federal project and will be constructed at the same time as SPPAs 3, 4 and 5. The general assumption was made that SPPA1 (95 acres) will be constructed by the City first, then SPPA2 will be constructed by the Federal project and SPPA1A (262 acres) constructed by the City will follow. If SPPA1 is not constructed by the time the Federal project is initiated, then SPPA2 will be constructed adjacent to PA6. The City will then construct SPPA1 and SPPA1-A.

Deepening and incidental widening of the Texas City Channel and Turning Basin will generate approximately 4.8 mcy of new work material and 43.6 mcy of maintenance material over the 50 year period of economic evaluation.

There are six semi-confined open water PAs, SPPA 1 thru 5 and Pelican Island PA, two reconfigured upland PAs on Shoal Point, PA5 and PA6, and two existing and one new open-water PAs on the north side of the Texas City dike. As mentioned above, the City of Texas City, the Non-Federal Sponsor, is responsible for the construction of SPPA1 and 1-A, as a result of their DA permit requirements. Most new work material removed during channel deepening will be used to construct the perimeter levees for SPPAs 2, 3, 4 and 5 and the Pelican Island PA.

The scheduled implementation plans for the placement of dredged material (new work and maintenance) are shown in Tables 18 and 19. Although the PAs will also be utilized by the Shoal Point Container Terminal Project for placement of material, Table 19 includes only the quantities of material from the Federal channel deepening project. Ultimately, SPPAs 1 through 5 and the Pelican Island PA will be converted to emergent marsh, thereby utilizing the dredged material in a beneficial manner.

Table 18
New-Work Dredging Quantities by Material Type

Reach	Construction-Grade (virgin, cy)	Maintenance-Grade (new-work, cy)	Maintenance (shoal, cy)	Total (cy)	Notes
1	172,000	618,000	125,000	915,000	To be placed in PAs 5 and 6.
2	2,364,000	0	710,000	3,074,000	To be placed as hydraulic fill for levee construction at SPPAs 2, 3, 4, and 5
3	256,000	0	94,000	350,000	To be placed as hydraulic fill to construct groins "A" and "B" and other fill at Texas City Dike.
4	491,000	0	19,000	510,000	To be placed as hydraulic fill for perimeter levee for Pelican Island PA
		Total Material, Federal Contract Dredge:		**4,849,000**	

Table 19
50-Year Dredged Material Management Plan Summary

Project Year	**Maintenance Material Quantities (cy)**								
	PA 2A-2C	**PA 5-6**	**SPPA 1**	**SPPA 1A**	**SPPA 2**	**SPPA 3**	**SPPA 4**	**SPPA 5**	**PIPA**	**Total**
1		970,000*								970,000
2										
3	1,170,000	350,000	558,000							2,078,000
4										0
5	970,000	350,000	89,000		469,000				200,000	2,078,000
6										0
7	1,170,000	350,000			558,000					2,078,000
8										0
9					558,000					558,000
10	1,170,000	350,000								1,520,000
11			50,000		151,000	357,000				558,000
12										

13	1,170,000	350,000				558,000				2,078,000
14										0
15				189,000		369,000				558,000
16	1,170,000	350,000								1,520,000
17				238,000		320,000				558,000
18										0
19	1,170,000	350,000		508,000	50,000					2,078,000
20										0
21	1,170,000	350,000		558,000						2,078,000
22										0
23				508,000		50,000				558,000
24	1,170,000	350,000								1,520,000
25				324,000			234,000			558,000
26										0
27	1,170,000	350,000					558,000			2,078,000
28										0
29	1,170,000	350,000					474,000	84,000		2,078,000
30										0
31								558,000		558,000
32	1,170,000	350,000								1,520,000
33								558,000		558,000
34										0
35	1,170,000	350,000		50,000				508,000		2,078,000
36										0
37		204,000						354,000		558,000
38	1,170,000	350,000								1,520,000
39		658,000								658,000
40										0
41	1,170,000	908,000					50,000			2,128,000
42										0
43	1,170,000	958,000								2,128,000
44										0
45	1,170,000	958,000								2,128,000
46										0
47	1,170,000	958,000								2,128,000
48										0
49	1,170,000	908,000						50,000		2,128,000
50										
Sub-total	22,030,000	11,422,000	697,000	2,375,000	1,786,000	1,654,000	1,316,000	2,112,000	200,000	43,592,000
									Total Quantities	43,592,000

* Maintenance-grade Material from deepening of Texas City Turning Basin

7.4 REAL ESTATE REQUIREMENTS

This project has no lands, easements, rights-of-way, or relocation (LERR) costs or costs for removal of pipelines. Pipelines within the project area are either at a sufficient depth so as not to be affected by the dredging or have been determined to be inactive and will be removed by others. A portion (about 350 acres) of the existing upland SPPA is owned by the Non-Federal Sponsor. All of the proposed sites identified for the open water PAs are owned by the Tx GLO and are subject to the Government's use of Navigation Servitude, a right that stems from the Commerce Clause of the Constitution which gives the Government the right to use navigable waters in aid of navigation without compensation. Detailed information concerning real estate requirements can be found in Real Estate Appendix B.

8.0 AFFECTED ENVIRONMENT

8.1 OVERVIEW

In November 2002 an EIS was completed for USACE Permit No. 21979 for the Shoal Point Container Terminal Project, including the deepening of the Texas City Channel to 45 feet. This assessment incorporates, by reference, data and information that pertains to the Texas City Channel Deepening Project from the Shoal Point Container Terminal EIS. 33 CFR 230.21 provides authorization for the district commander to adopt a Federal agency's EIS in full or partial compliance of NEPA. The EIS disclosed all environmental impacts associated with the proposed channel deepening for the permit action. The deepening impacts for the permit action are the same for the current Federal proposal to deepen the channel to 45 feet. For this reason a environmental assessment was prepared instead of an EIS. This assessment incorporates, by reference, data and information that pertains to the Texas City Channel Deepening Project from the Shoal Point Container Terminal EIS. Impacts of the proposed Federal project features that were not included in the EIS, the existing Turning Basin, the new PA on the north side of the Texas City Dike and the groins to be placed on the north side of the Dike, are fully disclosed and evaluated in this document. In addition, any environmental or regulatory changes that have occurred since the completion of the November 2002 EIS is discussed. Environmental consequences are discussed in Section 9.0.

8.2 ENVIRONMENTAL SETTING OF THE STUDY AREA

Physical Characteristics
The Texas City Channel project is located in Galveston Bay, an estuary where freshwater flows meet and mix with the salt water of the Gulf of Mexico (Figure 3). The bay is approximately 600 square miles in surface area, and is generally shallow, with typical water depths in the interior of the bay ranging from 5 to 12 feet. Dredged navigation channels, with depths ranging from 12 to 45 feet, transect the bay system. Galveston Bay consists of several subsystems: Trinity Bay, East Bay, the confined portion of the HSC above Morgan's Point, San Jacinto Bay, upper Galveston Bay (the area north of the Texas City Dike) and West Bay that includes the Texas City Channel project area.

An important feature in the bay system is the Texas City Dike along the west shore of Galveston Bay. This structure, which has existed in the Bay system in various forms since 1915, exerts an influence on the currents in the Bolivar Roads area and reduces the exchange of water between Galveston Bay and West Bay. At the same time, it reduces currents and sedimentation in the Texas City Channel. The channel is one of nine main navigation channels in the Galveston Bay complex. A detailed discussion of the area's physical characteristics can be found in Section 3.0 of the EIS.

Air Quality
The Clean Air Act (CAA), which was last amended in 1990, regulates air emissions from area, stationary, and mobile sources, and requires the EPA to set air quality standards for pollutants considered harmful to public health and the environment. Currently, there are air quality

standards for six “criteria” pollutants designated by EPA; carbon monoxide, nitrogen dioxide, ozone, lead, sulfur oxides, and invaluable airborne particulate matter.

The Houston-Galveston-Brazoria area (HGB), consisting of Montgomery, Liberty, Chambers, Galveston, Brazoria, Fort Bend, and Waller counties, fails to meet the EPA air quality standards for ozone. As a result, the HGB has been classified as “moderate” non-attainment for the EPA 8-hour standard for ozone. Under current regulations, the HGB has until 2010 to attain the EPA standard for ozone. In an ozone non-attainment area classified as moderate, if the total emissions of either nitrogen oxides (NOX) or volatile organic compounds (VOCs) related to the Federal action would equal or exceed 100 tons per year, the Federal agency must issue a General Conformity Determination. The determination must state how the project conforms or will conform to the State Implementation Plan (SIP) for that pollutant, before undertaking the action. Results of the Formal Air Conformity Analysis conducted for the Texas City Channel Deepening project are discussed in Section 9.

Noise

Noise is defined as unwanted sound that disrupts or interferes with normal activities or that diminishes the quality of the environment. Noise is usually caused by human activity and is added to the natural, or ambient, acoustic setting of an area. Exposure to high levels of noise over an extended period can cause health hazards such as hearing loss and the most common human response to environmental noise is annoyance.

Shoal Point is a dredged material placement area bordered by the Texas City Channel to the east and turning basin to the north and west, and by Galveston Bay to the east and southeast. Located immediately adjacent to the west and northwest of Shoal Point is a large area of heavy industrial land use consisting of chemical refineries and storage facilities, and transportational land use that includes rail and port facilities. The nearest noise sensitive receptors are located at a residential area lying approximately 4,500 feet from the site on the northwest side of the industrial facilities. Much of Pelican Island consists of leveed dredge material PAs. The GIWW separates the island from a small undeveloped island to the northwest, known as Pelican Spit. Facilities located on the island include Seawolf Park located on the far northeastern point of the island, Texas A&M University-Galveston located on the southeastern corner of the island, and maritime industries located along the southern shoreline. Detailed information concerning local noise levels, noise receptors and monitoring programs can be found in Section 3.3 of the EIS and is incorporated by reference.

Geology

The project area is situated near the seaward margin of the west Gulf Coastal Plain Physiographic Province (Bureau of Economic Geology (BEG), 1977). The region is characterized by a nearly continuous series of bays separated from the Gulf of Mexico by a system of barrier islands and peninsulas (Lankford and Rehkemper, 1969). The nature and distribution of these features along the coastline are a result of several active geologic processes, including the movement of sediment along the coast, wave action, wind erosion and deposition, tidal currents, and river deposits. A detailed technical description of the geology of the Galveston Bay area is contained in Section 3.5 of the EIS.

Energy and Mineral Resources

Resources produced in the project area and vicinity include oil and natural gas production, sulfur, brine, sand, clay, and shell for the production of lime and other materials. Chief among these resources is oil and natural gas. Sulfur is an important industrial mineral occurring primarily in the cap rock of certain regional salt domes. Oil and gas fields are densely distributed throughout the project area, but none are within the boundaries of the proposed project site.

Permitted oil/gas wells and pipelines were identified within a 1-mile radius of Shoal Point and Pelican Island. Fifteen oil and gas well sites occur within a 1-mile radius of Shoal Point. None of these sites occur within the footprint for the proposed project. Ten petroleum pipeline systems occur within a 1-mile radius of Shoal Point. The pipeline systems are listed as active and may contain more than one pipeline/pipeline segment. The pipeline systems are reported to transport a variety of materials including natural gas, refined products, propane, ethylene, liquefied petroleum gas (LPG), and crude oil.

The Railroad Commission of Texas database identified a total of 27 oil and gas well sites located within a 1-mile radius of Pelican Island. Five of these are located within the footprint for the Pelican Island site. One petroleum pipeline system was identified within a 1-mile radius of the Pelican Island site. The pipeline system contains two active pipelines, reported to transport natural gas. Detailed information concerning the energy and mineral resources of the project area can be found in Section 3.6 of the EIS.

Surface Soils

The land areas in the immediate vicinity of the proposed project site consist of the Shoal Point area and Pelican Island. Much the soil on these land areas was formed by dredged material from the bays and canals in the project area. Soils on Shoal Point consist of Ijam clay (0 to 2 percent slopes). This soil is a nearly level to gently sloping, poorly drained, moderately saline, clayey soil that has a clay subsoil (Soil Conservation Service, 1988). Permeability and surface runoff are very slow, and shrink-swell potential is high. This soil is found in coastal marshes and has formed in material dredged from bays and canals. Typically, this soil consists of calcareous, moderately alkaline, dark grayish brown to gray clay. In the Pelican Island area, the majority of the soils consist of Ijam clay (0 to 2 percent slopes) as described above. Areas in the eastern coastal portions of Pelican Island consist of Sievers loam (0 to 3 percent slopes), a soil that is nearly level to gently sloping, somewhat poorly drained, moderately saline, loamy soil that has a loamy subsoil. Detailed information concerning the soils in the project area can be found in Section 3.7 of the EIS.

Groundwater Quality and Hydrology

Groundwater in the vicinity of the project area is mostly withdrawn from the Gulf Coast Aquifer system. The Gulf Coast Aquifer is an underground water source consisting of a system of complexly inter-bedded clays, silts, sands, and gravels, which hydrologically connect five minor aquifers to form a large, leaky artesian aquifer system. Groundwater is generally of good quality in the shallower portions of the Gulf Coast Aquifer, except near the coast where saltwater intrusion limits the amount of freshwater available from the aquifer. Regional groundwater flow in the aquifers is generally southeastward from outcrop areas towards areas of natural discharge. Superimposed upon this natural discharge regime is artificial discharge caused by groundwater pumping. Because of historical groundwater development in the region, water levels declined and localized cones of depression developed around areas of extensive groundwater pumping, altering the natural flow pattern and causing groundwater to flow toward these centers of pumping. However, since the late 1970s and early 1980s, groundwater usage in the area has largely been replaced with surface water, which has resulted in the recovery of water levels in areas of decreased pumping.

Land-surface subsidence has affected most of the project region. Subsidence in the area primarily has been caused by groundwater withdrawals, although subsidence may also result from oil and gas production. Subsidence in the project area, coupled with an increase in impermeable surfaces, has subjected an increasingly large area along Galveston Bay and the HSC to flooding from high tides. Further subsidence has been successfully controlled in the region through the conversion from groundwater to surface water by cities, utility districts and industries, significantly reducing the amount of groundwater being pumped from the primary aquifers in the area. Detailed information concerning the groundwater and the project area hydrology can be found in Section 3.8 of the EIS.

Hazardous Materials Site Assessment

Since the project area for the Texas City Channel Project is encompassed within the area for the Hazardous Materials Site Assessment study conducted for the Shoal Point Container Terminal permit, pertinent information from the EIS was used for the Texas City Channel Deepening Project EA. The assessment was conducted following the American Society of Testing and Materials guidelines and Engineering Regulation 1165-2-132. Detailed information concerning the hazardous material assessment and location of sites and facilities for the project area can be found in Section 3.9 of the EIS.

Texas City Channel

According to the regulatory agency database report for the area around the Texas City Channel, Texas City Dike and Turning Basin, 136 listings are identified at 13 sites. Several sites are registered within multiple databases and multiple sites may be located at a single facility or map location. From the regulatory database searches, the following sites are located within the search area radius:

- one NPL site
- one CERCLIS site
- one State Superfund site
- two RCRA TSD sites
- one SWF site
- three RCRA generators sites
- three RCRA CORRACT sites
- one registered storage tank site
- one LUST site
- three facilities with 99 reported emergency response actions and 9 un-locatable reported emergency response actions
- fourteen NPDES sites

None of these listed sites are located in the footprint of the project and will not impact the project.

An underwater archeological survey of the channel was conducted to locate potential historic sites. The underwater survey has identified remnants of a civil war flagship in the project footprint. Debris from the shipwreck scattered along the channel bottom includes ordinance and potentially explosive waste. Removal of this hazardous material will be coordinated prior to construction. Additional information about the shipwreck can be found in the Cultural Resources section.

Pelican Island

According to the regulatory agency database report, 23 listings are identified at six sites within the Pelican Island database search area. The following sites are located within the Pelican Island search area:

- two CERCLIS sites
- two State Superfund sites
- three FINDS sites
- two TRIS sites
- three RCRA GEN sites
- two registered storage tank sites
- two NPDES sites
- seven facilities which reported emergency response actions

Surface Water Quality and Hydrology

This section includes a general discussion of Galveston Bay water quality and quantity information. Existing surface water monitoring data and other descriptive information regarding surface water conditions in the project area are presented in detail in Section 3.9 of the EIS.

General Conditions

The Houston-Galveston Area Council (H-GAC) maintains the Data and Mapping Resource Section, a clearinghouse for monitoring data, with oversight from the Galveston Bay Estuary Program (GBEP) and the Galveston Bay Monitoring Subcommittee. Several recent studies have summarized trends in water and sediment quality for the Galveston Bay area. General water quality trends (GBEP, 2001 a) include:

- A decline in salinity over the period of record
- A slight rise in summer temperatures
- An increase in dissolved oxygen
- A decline in ammonia-nitrogen and total phosphorus
- A 75 percent decline in chlorophyll-a over the period from 1975 to 2000
- A decline in fecal coliform bacteria levels over some portions of the bay

Under Section 303(d) of the Federal Clean Water Act (CWA), each state must identify waters that do not meet water quality standards established under the act. Areas in the Galveston Bay system that are included on the State's list of waters that do not meet water quality standards for particular pollutants include the following:

- Lower Galveston Bay is listed for excessive levels of copper in water and bacteria in oysters.
- The Texas City Channel is listed due to occasional low levels of dissolved oxygen.

Total suspended solids (TSS) values in the Galveston Bay system are generally higher near points of inflow, such as the Trinity or San Jacinto rivers, and lower toward the open-bay system (Ward and Armstrong, 1992). Background total suspended solids in the bay are generally below 100 mg/L.

Galveston Bay sediments are a mixture of fine sands, clays, and silts. A general sediment quality trend was identified for concentrations of metals and commonly measured organic compounds generally tend to be elevated near regions of runoff, inflow and waste discharges. Lower, more uniform concentrations exist in the open bay. (GBEP 2001 a).

Texas City Channel Area
The Texas City Channel is identified as water quality Segment 2437 by the TCEQ and has designated uses of High Quality Aquatic Habitat and Non-Contact Recreation. The salinity data in the Texas City Channel segment is slightly higher than the lower Galveston Bay segment, and dissolved oxygen is slightly lower. Based on the fecal coliform data available, both segments appear to meet contact recreation criteria.

The Texas City Channel has been used for navigation since the start of the 20th century. The current 40-foot project channel was completed in the mid 1960s and generally requires maintenance dredging approximately 2.4 mcy from the Channel, Turning Basin and Industrial Canal on a 3-year cycle. Two primary locations that have been used for placement of dredged material are on the north side of the Texas City Dike as beach nourishment and in Shoal Point. At times, there can be localized areas of higher suspended solids concentrations near the overflow weirs of confined PAs. Higher TSS concentrations are produced in the areas on the north side of the Texas City Dike where dredged material is placed in unconfined areas for beach nourishment. Elutriate tests are routinely performed on sediments prior to dredging to insure sediments and the discharge water do not exceed Texas Surface Water Quality Standards.

Pelican Island Area
One of the proposed PAs is located adjacent to Pelican Island. Waters adjacent to the island are part of lower Galveston Bay. The designated uses for segment 2439, Lower Galveston Bay, are Contact Recreation, High Quality Aquatic Life Use, and Oyster Habitat. Salinity at this site has a large range, but its average is close to half that of sea water. Although the total suspended solids can be high, it averages only 32 mg/L. Also, the coliform bacteria level is well below 200 colony forming units per deciliter, which is the criterion for contact recreation use.

Vegetation
The project area is located within the Gulf Coast Prairies and Marshes Natural Region. The Upper Coastal Prairie of Texas (approximately 21,000 square miles) is a narrow strip,

approximately 50 miles wide, that borders the coastal marshes from Matagorda Bay to the Sabine River and corresponds to the wetter side of the Texas Coastal Prairie. Average annual rainfall increases from west to east and ranges from 30 to 50 inches per year. The region includes barrier islands on the coastline, estuarine marshes, remnant tall grass prairies (most converted to agricultural and/or developed lands), oak parklands, and oak mottes. Forested wetlands and riparian woodlands occur in the river bottomlands. Detailed information concerning Gulf Coast vegetation, including upland plant communities, marshes, and submerged aquatic vegetation can be found in Section 3.11 of the EIS and is incorporated by reference

Terrestrial Wildlife
On Shoal Point and Pelican Island, wildlife habitat is severely restricted because the sites are active PAs that are periodically inundated. The western portion of Shoal Point has not been used for placement of material for many years and currently supports a shrub-dominated vegetation community that provides habitat for a variety of wildlife species. Amphibians are not likely to occur in the project area due to the lack of freshwater habitat. The EIS provides detailed information on regional and local habitat and species of reptiles, birds, and mammals that may occur in the project area.

Aquatic Ecology
The Galveston Bay system provides important nursery habitat for numerous commercially and recreationally important estuarine-dependent fish and shellfish species, as well as providing habitat for marine mammals, reptiles, resident birds, wintering waterfowl, shorebirds, and other avian species. The immediate watershed of Galveston Bay also provides a variety of freshwater habitats. This section describes the dominant types of aquatic habitat present within the Galveston Bay system. The EIS provides extensive information on open-bay habitat, open-bay bottom habitat, the open-bay communities, seagrass beds, salt marshes and recreational and commercial fisheries.

Essential Fish Habitat
Congress enacted amendments to the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA) (PL 94-265) in 1996 that established procedures for identifying Essential Fish Habitat (EFH) and required interagency coordination to further the conservation of federally managed fisheries. As set forth in NMFS rules, EFH Assessments must include a description of the proposed action, an analysis of the effects, including cumulative effects of the action on EFH, the managed species, and associated species by life history stages, and include the Federal agency's views regarding the effects of the action on EFH in this EA.

Since the Shoal Point Container Terminal project sites are located in an area that has been identified by the Gulf of Mexico Fisheries Management Council (GMFMC) as EFH for adult and juvenile brown and white shrimp, red drum, and Spanish mackerel; an EFH Assessment was conducted for the EIS. EFH for these species in the vicinity of the project includes estuarine emergent wetlands; estuarine mud, sand and shell substrates; Submerged Aquatic Vegetation and estuarine water column. Detailed information on red drum, shrimp, and other federally managed fisheries and their EFH is provided in the 1998 EFH amendment of the Fishery Management Plans for the Gulf of Mexico, prepared by the GMFMC. The preferred habitat, life history stages, and relative abundance of each EFH managed species is described in detail in Section 3.14.8 of the EIS.

Threatened and Endangered Species

Descriptions of threatened and endangered species are presented in the Biological Assessment prepared for this project (Appendix I). Section 3.15 of the Shoal Point Container Terminal EIS describes in detail the habitat and life-cycle of threatened and endangered species, as well as species of concern, that may occur in Galveston, Harris and Chambers Counties. Table 20 lists the threatened and endangered species and critical habitat identified by the USFWS and NMFS that may occur in the Texas City Channel project area in Galveston County.

Table 20
Threatened and Endangered Species Potentially Present in the Federal Project Area

Common Name	Scientific Name	Status	Jurisdiction
BIRDS			
brown pelican	*Pelecanus occidentalis*	E	USWFS
piping plover	*Charadrius melodus*	T; CH	USFWS
reddish egret	*Egretta rufescens*	SOC	USFWS
TURTLES			
Texas diamondback terrapin	*Malaclemys terrapin littoralis*	SOC	USFWS
green sea turtle	*Chelonia mydas*	T	NMFS USFWS
Kemp's ridley sea turtle	*Lepidochelys kempii*	E	NMFS USFWS
loggerhead sea turtle	*Caretta caretta*	T	NMFS USFWS
FISH			
largetooth sawfish	*Pristis pristis*	SOC	NMFS
saltmarsh topminnow	*Fundulus jenkinsi*	SOC	NMFS

TPWD has listed six species as endangered and 17 species as threatened that have some probability of occurring in Galveston County. Some species are migrants or wintering residents only, or may be historic. Additional information concerning the listed species can be found in Section 9 and in Appendix E, Agency Coordination/Consultation.

Cultural Resources

Archival research initially conducted for the Shoal Point Container Terminal (SPCT) permit application (21979) can be applied to the Texas City Channel (TCC) Federal navigation improvements project. A synopsis of previous marine historic properties investigations in the Federal project area and vicinity can be found in the November 2002 Environmental Impact Statement entitled, *US Army Corps of Engineers, Galveston District, Final Environmental*

Impact Statement for Texas City's Proposed Shoal Point Container Terminal prepared by PBS&J for the City of Texas City.

<u>The USS *Westfield* (41GV151)</u>

The USS *Westfield*, a U.S. Navy flagship that ran aground during the Battle of Galveston and was scuttled to prevent capture on January 1, 1863, is situated partially within the TCC proposed for deepening; therefore, as mandated by Section 106 of the National Historic Preservation Act, the USACE must consider the effects of the proposed project on the wreck. The US Government owns the remains of the USS *Westfield*, since it was an active military vessel when it wrecked. Now that the site has been located, the US Naval Historical Center, the Texas State Historic Preservation Officer (SHPO) and the USACE will be active partners in coordinating the wrecks' potential eligibility for the National Register of Historic Places (NRHP).

Fieldwork to determine if site 41GV151 is potentially eligible for listing in the National Register of Historic Place (NRHP) was conducted by PBS&J in May and June of 2006. The site was conclusively identified as the remains of the USS *Westfield*. The Westfield is recommended as eligible for listing in the NRHP under criteria A, B and D.

Commercial and Recreational Navigation

Galveston Bay is a major center of both commercial and recreational navigation. Concentrations of recreational boating facilities and activity exist at Galveston and Texas City. Commercial fishing in the bay is a major activity. Both activities have traditionally coexisted with deep-draft commercial navigation. Generally this means that recreational boats stay clear of larger commercial vessels that are restricted to navigation in the dredged channels. Deep navigation channels may be more heavily used than in the present, and this would limit recreational and fishing vessel activity in these areas. However, the vast majority of the bay system area is outside of the navigation channels, and this area will be unaffected by the project. Section 3.17 of the EIS contains detailed information on commercial and recreational navigation, including vessel tonnage and traffic restrictions.

Land Use/Recreation/Aesthetics

Many of the parks and recreational activities are oriented toward water-based activities such as fishing, swimming, windsurfing, boating, birding, and other aquatic-based recreation. Public parks in the project area include Seawolf Park; the Texas City Dike Park which has bait shops, fishing piers, beaches, and boat ramps; and the Bay Street Park, the largest Texas City park, including playgrounds, sports fields, nature trails, and other typical municipal park amenities. The following land use information was excerpted from Section 3.18 of the EIS, where more detailed information can be found.

Shoal Point PA

Shoal Point lies within the corporate limits of Texas City on Shoal Point peninsula. The site consists of two active PAs (transitional areas) and one inactive PA that is now mainly a shrub/brush rangeland. The site is accessed by a levee road which intersects with Loop 197. To the west of the site is a large area of industrial land use, primarily occupied by chemical refineries and storage facilities, and transportational land use, primarily rail and port facilities. TCT (Texas City Terminal Railway) lines and electrical transmission lines traverse the industrial area. Shoal Point is separated from the industrial area and transportation facilities by the Texas City Channel and turning basin. To the north of the site lies the Texas City Dike, a five-mile-long jetty used for fishing, boating, and swimming. Beyond the industrial areas to the west and northwest of the project area lie older residential and commercial areas of Texas City, numerous City parks, various churches, and an historical park. Many of the commercial establishments appear to be abandoned.

Pelican Island PA

Pelican Island lies within the corporate limits of Galveston to the north of Galveston Island and is accessed via Pelican Island Causeway from Galveston Island and Seawolf Parkway across the island. The GIWW separates Pelican Island from a small island (Pelican Spit) to the northwest. The proposed beneficial use site is located on the western shore of the island approximately one-half mile south of Pelican Spit, which is undeveloped. The only landside access to the beneficial use site is by a levee road. The Texas City Channel parallels the site to the northeast, and is intersected by the HSC and the Bolivar Roads Channel in the vicinity of Seawolf Park. A United States Geological Survey (USGS) 7.5-minute topographical map of the site shows various towers and lights in the vicinity, and a gas well nearly 1 mile west of the site. Beyond the 1-mile boundary, maritime industries and Texas A&M University-Galveston occur along the southern flank of the island. At the far eastern corner of Pelican Island lies Seawolf Park.

Texas City Dike

Paralleling the north side of the Texas City Channel is the Texas City Dike, from which the Pelican Island site is visible. North of the dike is the HSC. The Sampson Yarborough boat ramp, a bait shop, and a restaurant lie at the end of the dike. Boat ramps are also located on the dike. Two areas on the north side of the dike are used for placement of sandy material dredged from the channel. Periodic replenishment of the beach protects the integrity of the dike from strong currents, and secondarily, provides recreation areas.

Socioeconomics

Significant socioeconomic factors realized through the implementation of this project were documented in the study conducted for the Shoal Point Container Terminal EIS (Section 4.2.20). Factors expecting to experience positive change are Population, Community Values, Housing, Employment; Construction and Household Income. A detailed socioeconomic baseline was developed for the Shoal Point Container Terminal EIS (Section 3.19), which includes the Texas City Channel project area.

Population

The proposed project site lies in Galveston County. Historically, the Houston Consolidated Metropolitan Statistical Area (CMSA) has grown at a faster rate than the state as a whole. As a benchmark against which to compare sub-regional growth, the state has increased in population by 86 percent over the past 30 years (1970-2000) and Houston CMSA has more than doubled in population, growing by 114 percent during the same period (U.S. Bureau of Census, various years). Texas City has maintained a relatively stable population, experiencing only seven percent growth over the same period, including a period of decline in the 1980s. Galveston has been steadily losing population, with a seven percent loss in population since 1970.

Social Characteristics

Population by Race and Ethnicity

While the state was 53 percent Anglo in 2000, the Houston CMSA was 49 percent Anglo. The Houston CMSA had a greater proportion of African Americans [or Blacks] (17%) than the state (12%) and lesser Hispanic representation (29% versus the State's 32%). Galveston and Texas City have comparatively large African American populations (26 and 27%, respectively), while Pasadena and Baytown have large Hispanic populations, with 48 percent and 34 percent, respectively, and the surrounding communities are predominantly Anglo (>80%). In 2000, the median age of residents in both Texas City and Galveston was 35.5, compared to state's median age of 32.3 years. In 2000, Galveston had a relatively low household size of 2.30.

Compared to surrounding communities, Texas City had a lower percentage of college graduates. In 1990, a somewhat smaller proportion of Houston CMSA residents lived below the poverty level compared with the State, amounting to 15 percent compared with the State's 18 percent. Galveston had a comparatively high percentage (24%). The cities of Texas City and Galveston developed comprehensive development plans for the communities as they would relate to the development of the Shoal Point Container Terminal and the Texas City Channel Project in a plan to identify and promote community values. This information is contained in Section 3.19 of the EIS.

The EIS also considered housing, occupancy, economic characteristics of the area population (including occupation, location, and travel) and household and per capita income. Leading economic sectors used to provide an economic profile of the coastal counties include the number of establishments, sales or shipments, payroll and number of employees, the labor force, unemployment rates, and personal income.

Tourism

General Tourism

The EIS presents detailed information on economic indicators of the impact of travel on Texas and on the Gulf Coast. The Gulf Coast region represents 20 to 25 percent of Texas expenditures, earnings, employment, and tax receipts. Over the 1994 through 1999 period, growth in Gulf Coast tourism exceeded growth in that sector for the State (Texas Department of Economic Development, 2001).

Ecotourism

The study region is located within the Central Flyway for coastal and trans-oceanic bird migration and is thus an attraction for ecotourism and birding. In particular, Texas City was declared, by city ordinance, to be a bird sanctuary. A study commissioned by the TPWD (Eubanks, 1999) found that an average visitor to the Great Texas Coastal Birding Trail in the Gulf Coast region spent approximately 9 days and 8 nights recreationally, spending $78.52 per person per day in coastal areas. Annually, each visiting birder spent an average of 31.23 days per year birding along the Trail, thus averaging $2,452.18 of direct coastal spending per person annually.

Recreational Fishing
As a destination for anglers, the Texas Gulf Coast enjoys economic benefits from recreational fishing. According to the 1996 National Survey of Fishing, Hunting and Wildlife-Associated Recreation (USFWS, 1998), approximately 862,000 recreational anglers over 15 years old participated in 13.03 million days of saltwater fishing on the Texas coast, with an average of 15 days per angler. Approximately 94 percent of those anglers are Texas residents. Those anglers spent $725.4 million, including $202.6 million for food and lodging. On average, each spent $841, including $235 for food and lodging, in the Gulf Coast region. Thus, recreational fishing is a major source of tourism income for the region.

Oil and Gas Production
Oil and gas production is a major industry in the Houston CMSA. The EIS presented detailed information on the number of oil and gas wells and production statistics. The Houston CMSA contains 3.1 percent of the State's oil wells and 2.8 percent of its gas wells (RCT, 2001). From 1996 to 1999, 5-6 percent of gas well gas was produced in the Houston CMSA, as well as 3 to 6 percent of casinghead. Three percent of the state's crude oil was pumped in the Houston CMSA and 8 to 11 percent of condensate was produced in the region.

Public Finance
The Shoal Point Container Terminal EIS provides detailed information and tables for tax rate and appraisal information for the major taxing jurisdictions in the vicinity of the project area.

Environmental Justice
To comply with requirements of Executive Order (EO) 12898 Federal Action to Address Environmental Justice (EJ) in Minority Populations and Low-Income Populations, a two-part study was performed for Section 3.19.11 of the EIS and is incorporated by reference. The first part of the study employed the EJ Index Methodology, which is a base analysis created by the EPA, Region 6. The EJ Index helps determine if further investigation of a study area is needed. Further analyses were performed using the U.S. Bureau of Census (USBOC) tract and block level data. This methodology is discussed in detail in the EIS.
Three levels of analysis are provided in the EJ Index, as defined below:

<u>Minority Status Degree of Vulnerability</u> EPA Minority Status Degree of Vulnerability maps portray the degree of vulnerability for minority status by census blocks. This factor is derived by comparing the area's percentage of minority population (based on census block data) with the state percentage (39.4%). Minority status is defined to include all non-white as well as Hispanic-origin households.

<u>Economic Status Degree of Vulnerability</u> The EPA Economic Status Degree of Vulnerability maps show the potential degree of vulnerability based on household income (the risk group is defined as households with incomes less than $15,000 per year). The State's percentage of such households is 27.6 percent.

Potential Environmental Justice Index The EPA Potential Environmental Justice Index maps show a composite index incorporating population density, income and ethnicity factors. As this number is a relative determination based on several factors, there is no State EJ index number for comparison purposes.

Census Tract Analysis

The data used in this study to determine the potential for disproportionate effects to low-income and/or minority populations within the vicinity of each of the project sites are presented in detail in the EIS. The information is based on 1990 USBOC county, census tract, and block level data for ethnicity and income. The decision regarding which census tracts and blocks to use was based on the proximity to the project area and the possibility of beneficial or adverse effects potentially accruing to a particular population. Tract 1229.22, block I was used for the Shoal Point site because of the possibility of increased traffic. The census tract and block level data were compared with county level data. A threshold of 10 percent over the county's average percentage of ethnic minorities and economically stressed persons was used to evaluate whether a disproportionate percentage of such groups live within the potentially affected areas.

A sensitivity analysis of the Shoal Point alternative, which included the Texas City Channel feature, showed that using a threshold of either 5 or 15 percent yielded no difference in the findings of each of the demographic groups or economically stressed populations. Therefore, the 10 percent threshold was deemed reasonable and was used as the threshold for the project.

Community Infrastructure and Municipal Services

Section 3.20 of the EIS is a compilation of information regarding utility providers, storm water and drainage services, major streets and public transportation facilities, waste disposal facilities, hospitals security and fire protection currently available at the project sites, and is incorporated by reference. Storm water and drainage are handled by a series of ditches that carry storm water runoff to bayous and to the bay. Water, sewer, gas, electricity, telephone and cable utilities are located in the vicinity of Shoal Point, the Texas City Dike and Pelican Island.

Residential Property Values

Impacts on residential property values focused on traffic noise. According to "The External Damage Cost of Noise Emitted from Motor Vehicles" (Delucchi and Hsu, 1998), property values may decrease from 0.2 to 1.5% for every dBA above 55 dBA, which was established as the threshold "below which most people will not be annoyed and above which most will be annoyed". Existing noise levels for sensitive receptors are presented in the EIS and in the appropriate impact discussions in Section 4.0 and are incorporated by reference. The existing without-project noise levels exceed 55 dBA for most receptors; thus current residential property values already reflect the impact of current project noise levels on property valuation.

9.0 ENVIRONMENTAL CONSEQUENCES

9.1 OVERVIEW

This section discusses the environmental consequences likely to occur from construction and maintenance of the selected plan. The Shoal Point Container Terminal EIS described impacts associated with deepening the Texas City Channel to 45 feet and the construction of placement areas SPPA 1, 1A, 2, 3, 4, 5, and Pelican Island PA. All of these features are being incorporated into the Federal project. Discussion of impacts from construction of these features can be found in the Environmental Consequences Section (Section 4.0) of the EIS. The permit EIS is incorporated by reference as it pertains to the Texas City Channel Deepening Federal project.

PAs 2A, 2B, 5, and 6 are existing PAs associated with maintenance dredging of the 40-foot project and have been previously coordinated for use. All four areas will continue to be used for maintenance dredging activities associated with the 45-foot project.

Proposed Federal project features that are not included in the EIS are the deepening of the existing Turning Basin, some incidental widening of the bend in the channel; the use of PA 2C - a new 75-acre beach nourishment PA on the north side of the Texas City Dike; and the construction of two 500-foot long groins on the north side of the dike to contain material placed in PA 2C. This environmental assessment discusses the impacts associated with the new project features.

As part of the plan formulation for the Federal project, four alternatives were evaluated in addition to No Action. They included deepening the channel to depths of 43, 44, 45, and 48-feet. A comparison of the significant environmental resources for each depth alternative is shown in Table 21. Also included is the 50-foot authorized plan. Environmental impacts associated with the 50-foot project are described in the "Galveston Bay Area, Texas, Final Interim Feasibility Report and Environmental Impact Statement, Texas City Channel" dated 1983.

The environmental impacts for the 43, 44, 45, and 48-foot project depths are very similar. While the quantities of material vary based on the depth of dredging, all three alternatives would utilize the same footprint for the PAs as the 45-foot project. The main difference in the plans would be the height of the confinement levees for the marsh creation sites at SPPA 1, 1A, 2, 3, 4, 5, and Pelican Island. Therefore, the subsequent discussion of impacts are described for the 45-foot project depth. For the 48-foot alternative, an additional 6.8 miles of channel would need to be dredged from the intersection with the HSC to the Gulf, since the current depth of the HSC is only 45 feet. New work and maintenance material from this reach of channel would be placed in existing designated offshore placement areas. As a result of the increased dredging quantity for the 48-foot alternative, an increase in the dredging time would also occur. Consequently, impacts to air quality and water quality will be greater and these are discussed as well.

Table 21
Quantity and Cost Comparison of Project Alternatives

Feature	43-Foot	44-Foot	45-Foot	48-Foot	50-Foot
Channel Length (miles)	Same as 45-ft	Same as 45-ft	7.6	14.4	17
Estimated Cubic Yards Dredged	3,660,000	4,250,000	4,849,000	11,825,000	18,655,000
Placement Areas	Same as 45-ft	Same as 45-ft	SPPA 1,2,3,4,5; PIPA; PA 2A, 2B,2C, 5, 6	Same as 45-ft & ocean disposal	PA 5, 6; 600-ac wetland site; 90-ac upland site; ocean disposal
Bay Bottom	Same as 45-ft	Same as 45-ft	1,162 acres impacted	Same as 45-ft	730 acres impacted
Wetlands	Same as 45-ft	Same as 45-ft	999 acres of emergent marsh created	Same as 45-ft	600 acres of emergent marsh created
Endangered Species	Same as 45-ft	Same as 45-ft	No impact; positive effect due to marsh creation	Same as 45-ft	Little to no effect; potential positive effect due to marsh creation
Cultural Resources	No effect	No effect	Impact to one National Register eligible site	Same as 45-ft	Same as 45-ft
Water Quality	Minimal salinity increase; temporary elevated turbidity	Slightly higher salinity than 43-ft but less than 44-ft; temporary elevated turbidity	Slightly higher salinity than 44-ft; temporary elevated turbidity	Slightly higher salinity than 45-ft; slightly longer elevated turbidity level than 45-ft	Slightly higher salinity than 48-ft; slightly longer elevated turbidity level than 48-ft
Air Quality	Slightly lower VOC and NOx generated during construction than 44-ft due to shorter construction time	Slightly lower VOC and NOx generated during construction than 45-ft due to longer construction time	Air analysis ongoing – TCEQ compliance is expected	Slightly higher VOC and NOx generated during construction than 45-ft due to longer construction time	Slightly higher VOC and NOx generated during construction than 48-ft due to longer construction time
Vegetation	No effect	No effect	No effect	No effect	No effect
Aquatic Areas	Same as 45-ft	Same as 45-ft	Temporary elevated turbidity; possible substrate community impact; avoids oyster habitat	Same as 45-ft	Same as Essential Fish Habitat
Essential Fish Habitat	Same as 45-ft	Same as 45-ft	1,162 acres of shallow bay impacted to create 999 acres of marsh; 76 acres for beach nourishment and groins	Same as 45-ft	730 acres of bay bottom covered; 105 acres shallow bay disturbed; adequate mitigation from marsh

					creation
Socioeconomics	Growth potential threatened; current economic trends continue; community stability and cohesiveness maintained; no safety aspects provided to shipping	Same as 43-ft	Growth potential sustained; current economic trends in continue; community stability and cohesiveness maintained; safety aspects provided to shipping	Same as 45-ft	Same as 45-ft
Recreation	Same as 45-ft	Same as 45-ft	76 acre beach nourishment site created at the dike; two groins to contain material. Local support for recreational development	Same as 45-ft	90 acres upland site at the dike possible detriment; Local support for recreational development

9.2 SELECTED PLAN

Physiography, Topography, Bathymetry and Geology

Dredging activities required to deepen the Texas City Channel and turning basin will permanently alter the bay bottom bathymetry. The current channel would be deepened by five feet to 45 feet from Shoal Point to the intersection with the HSC while maintaining the current 400-foot width. Surface topography changes are primarily associated with construction of the PAs and the Texas City Dike groins. Approximately 256,000 CY of new work material and 94,000 CY of shoaled material dredged from Station 28+000 to Station 31+000 to ease a bend in the channel will be used to construct two groins at the Texas City Dike and fill the PAs. Construction of the groins and filling the area will result in 76 acres of bay bottom impacts. Approximately 4.8 mcy of material dredged from the channel and turning basin will be utilized for construction of containment levees for PAs that can beneficially use the material, and for construction of groins on the Texas City Dike to entrap and retain the material. Approximately 1,086 acres of bay bottom will be impacted to construct the PAs, and will eventually result in 999 acres of emergent marsh (Figure 4 and Table 22). These bathymetry and topography changes are expected to have negligible impacts on the submerged and subaerial portions of the project. Impacts to the local geology due to the project were identified in the EIS. These include redistribution of sediment, local increases in turbidity and potential increases of local scouring and shoaling. These net impacts on the local geology are considered minimal.

<table>
<tr><th colspan="3">Table 22
PA Impacts and Marsh Creation</th></tr>
<tr><td>Placement Areas</td><td>Bay Bottom Impacted (acres)</td><td>Emergent Marsh Created (acres)</td></tr>
<tr><td>SPPA 1*</td><td rowspan="2">357</td><td>95</td></tr>
<tr><td>SPPA 1A*</td><td>262</td></tr>
<tr><td>SPPA 2</td><td>156</td><td>124</td></tr>
<tr><td>SPPA 3</td><td rowspan="3">469</td><td>138</td></tr>
<tr><td>SPPA 4</td><td>120</td></tr>
<tr><td>SPPA 5</td><td>161</td></tr>
<tr><td>Pelican Island PA</td><td>104</td><td>99</td></tr>
<tr><td>PA 2C</td><td>75</td><td>NA</td></tr>
<tr><td>PA 2C groins</td><td>0.6</td><td>NA</td></tr>
</table>

*To be constructed by the Non-Federal Sponsor

Air Quality

The Texas City Channel is located in Galveston County, Texas, which is located in the HGB ozone nonattainment area. The EPA has designated Galveston County to be in moderate non-attainment for the 8-hour standard for ozone. Detailed information from the EPA's emissions inventory was utilized to describe the HGB air quality for the Shoal Point Container Terminal permit and information from the EIS that is relevant to the Texas City Channel Deepening Project is incorporated by reference (EIS Section 3.1). Sources of emissions in this area are subject to the TCEQ State Implementation Plan (SIP) requirements for control of ozone precursors, NOx and VOCs. A preliminary air conformity analysis that was conducted included a detailed emissions determination, regional significance and dispersion modeling. The General Conformity Rule requires that potential emissions generated by any project-related demolition or construction activity and/or increased operation activities be determined on an annual basis and compared to the annual *de minimis* levels for those pollutants for which the area is classified as non-attainment or maintenance (Table 23). Emissions attributable to operational activities and construction were analyzed for NOx and VOCs.

Table 23
Attainment Classification and *de minimis* Emission Levels

AREA	CLASSIFICATION	VOC tpy	NOx tpy
Houston/Galveston (8-county area)	Moderate ozone non-attainment	100	100

In estimating operational-related dredging, tug, booster pump, track hoe, dragline, dozer and other equipment emissions, the EPA NONROAD Emissions Factors or AP-42 emission factors were used if other emissions information was not provided. In estimating construction-related NOx and VOC emissions, the usage of equipment, the likely duration of each activity, and manpower estimates for each activity for the construction, were determined based on past experience for similar types of dredging projects. All equipment was assumed to be diesel-powered unless otherwise noted. Estimates of construction equipment emissions were based on the estimated hours of usage and emission factors for each source.

The difference in air quality impacts from dredging the project to 43 or 44 feet would be a slightly lower emissions output than the 45-foot project alternative, whereas the difference in emissions from dredging the project to 48 feet would be a slightly higher emissions output than the 45-foot project alternative.

A General Air Conformity Analysis to determine potential air quality impacts is being conducted for construction of the Federal 45-foot channel, turning basin, dredged material placement areas, and construction of the two armored groins. Coordination with the TCEQ is ongoing to insure the project complies with the local SIP. When the draft air conformity analysis is completed the entire analysis will be located in Appendix D.

Roadway Traffic Impact Analysis
Most of the construction traffic to dredge the Texas City Channel and turning basin, build the six cells for the three PAs and the two rock groins at the Texas City Dike would be from the daily workers transiting to and from staging areas. It is expected that most of the equipment required to construct the channel project will be brought in by barge rather than via the roadways. Therefore, only minimal traffic impacts are anticipated as a direct result of the project.

Noise
The proposed project is located in an industrial area that generates elevated noise levels from ongoing operations, 24-hours a day, seven days a week. Noise associated with the project would

be generated during construction and during maintenance dredging activities. Major sources of noise associated with deepening the channel to 45 feet would be generated by the dredge, support work boats, heavy equipment used to move and place riprap on the Texas City Dike groins. It is expected that most of the equipment required to construct the channel project will be brought in by barge. The nearest residential receptors are located 4,500 feet northwest of the Turning Basin. The west end of the project, adjacent to Shoal Point, is the closest part of the project to residential receptors, with the majority of the project further away from receptors. Noise levels would be expected to increase temporarily during the construction phase. Noise generated by construction of the project is not expected to exceed the existing noise level at the nearest residential receptor. Therefore, no significant adverse noise effects are anticipated as a direct result of the project.

Energy and Mineral Resources

The selected plan would have no impacts on energy resources in the project area. There are no active petroleum wells in the project alignment and PAs. There are no known facilities or utilities to be relocated within the project area.

Surface Soils

The selected plan would not impact surface soils within the project area. Maintenance material dredged during the life of the project is designed for placement as fill in newly constructed PAs to build up the sites for creation of marshes. Material high in sand content placed on the beach on the north side of the Texas City Dike (PAs 2A, 2B and 2C) is designed to replenish beach material and protect the integrity of the dike.

Groundwater and Hydrology

Soils that will be excavated consist primarily of soft to stiff clays with some lenses of sand and gravel. Sand lenses that may be excavated will not provide an effective conduit to an aquifer. As such, no groundwater will be intercepted or is expected to be withdrawn as a direct result of the proposed project. Construction and maintenance of the selected plan will not impact area groundwater recharge and groundwater quality or quantity. Any shallow groundwater contamination that could occur during construction of the project will be minimized by the use of best management practices and compliance with Federal, State and local regulations.

Hazardous Materials

Construction and maintenance of the selected plan will not impact hazardous waste sites identified in the surrounding area but are well outside the project footprint. Use of hazardous materials during construction of the project is expected to have minimal risk of impact. Fuel storage tanks, oil drums and other regulated materials will likely be staged in or near the project construction zone. Construction of the project will allow larger ships carrying hazardous cargo to enter the Port of Texas City. An indirect impact of the project would be the potential for an increase for spills due to an increase in hazardous cargo shipped through the port and transported by rail or truck. The potential risk for spillage of these materials is reduced with implementation of spill response plans and use of best management practices during and after construction.

An underwater archeological survey of the channel identified ordinance and potentially explosive waste among the debris of a wrecked civil war flagship in the project footprint. This hazardous material will be removed from the channel prior to construction and removal will be coordinated with the SHPO and the U.S. Navy. Additional information about the shipwreck can be found in the Cultural Resources section.

Surface Water Quality
Dredging to construct levees for the six new PAs will cause short-term increases in turbidity at the dredging site and at the PA sites. Results of bioassays conducted in 1987 concluded that the dredged material would cause no significant undesirable effects. Also, laboratory results of representative samples of material to be dredged that were chemically and physically analyzed five times over the last 15 years have shown that no water quality standards for toxic contaminants will be exceeded during dredging activities and that the material is environmentally suitable for upland or aquatic disposal and for beneficial uses.

Studies conducted for the EIS included 2-demensional modeling of the effects of salinity changes due to deepening the Texas City Channel by five feet (PBS&J 2002) and are incorporated by reference (Section 4.2.10). The Texas City Channel is essentially a dead-end channel and has little freshwater flow at the upstream end of the channel. Some short-term decrease in salinity should be expected in the upper channel area following runoff from heavy rains producing freshwater inflows. In stable dry conditions when salinities in Texas City Channel and West Bay are essentially equal to those of the near-shore Gulf, the effect of deepening the channel is expected to be very small. On the average, salinity in the Texas City Harbor is expected to be slightly higher, but not have significant impacts. The difference in salinity impacts from dredging the project to 43 or 44 feet would be a slightly lower salinity effect than the 45-foot project alternative, whereas the difference in salinity impacts from dredging the project to 48 feet would be a slightly higher salinity effect than the 45-foot project alternative.

Vegetation
The selected plan would have no direct impact on plant communities because no upland habitat would be disturbed. Material dredged from the channel would be used to construct levees for PAs and groins for the Texas City Dike, and maintenance material would be disposed in existing or newly constructed leveed aquatic PAs. Over time, some plant communities will become established after placement of material in the PAs up to a suitable elevation and create habitat that will evolve over time.

Wetlands and Open Water
No wetlands will be impacted by the proposed project. Open water impacts include deepening the channel from 40 feet to 45 feet, constructing dredged material PAs adjacent to Shoal Point and Pelican Island and the construction of two submerged groins on the north side of the Texas City Dike. The Shoal Point and Pelican Island PAs will impact 1,086 acres of open bay bottom. However, the sites ultimately will be converted into emergent marsh. The DMMP for the project is primarily the DMMP that was developed during the 2002 EIS process. The plan was developed in coordination with the resource agencies and has been adopted for the Texas City Channel Deepening project. Approximately 75 acres of open bay bottom will be impacted by the PA 2C and 0.6 acres of open bay bottom will be impacted by the construction of the groins on the north side of the dike.

Terrestrial Wildlife
No impacts will occur to terrestrial wildlife as there will be little to no clearing of vegetation that would destroy wildlife habitat during construction of the selected plan since the PA construction occurs in the submerged environment. Placement of dredged material in confined cells will eventually create marsh habitat for wildlife loafing, nesting, or foraging.

Aquatic Ecology
An evaluation of environmental consequences on the aquatic environment for the EIS determined that construction and maintenance of the Texas City Channel and turning basin is expected to cause temporary, elevated turbidities that may affect some aquatic organisms near the dredge activity. Turbidities in open-bay habitat would be expected to return to near ambient conditions after dredging ceases. Construction of PA levees with new work material is expected to result in a fluid mud flow, with fine silt particles settling out over the bottom for up to 2,500 feet from the placement center, possibly impacting aquatic substrate communities. Following levee construction, re-colonization of the sediments by aquatic substrate communities is expected to occur over a 3-12 month time period. Also, areas of hard bottom within the mud flow zone could be buried and become unsuitable for oyster habitat. Positioning the PA a sufficient distance away from identified oyster reefs will minimize adverse impacts to the oysters. It is likely that areas with hard substrate experience enough wave energy to re-suspend the material and revert the substrate to original conditions after the levees are complete.

Essential Fish Habitat (EFH)
The loss of productive EFH during construction of the PAs will have temporary adverse impacts on adult and juvenile brown and white shrimp and red drum. However, the establishment of new marsh areas will benefit these species by creating new intertidal habitat. As a conservation measure to ensure minimal impacts to EFH and to ensure consistency with the EFH provisions of the MSFCMA, the selected plan will maintain openings for tidal influence to SPPA 1-5 until such time as they are needed for maintenance dredging.

Threatened and Endangered Species
Impacts to threatened and endangered species are addressed in the Biological Assessment prepared for this project (Appendix I). An evaluation of environmental consequences of threatened and endangered species for the EIS, which includes construction of the Texas City Channel and Turning Basin, determined that placement of dredged material in confined cells will benefit fisheries by providing bay bottom relief, creating marsh habitat and refuge for small fish and shellfish, which in turn will likely attract wading birds. Construction is not expected to impact Kemp's ridley (*Lepidochelys kempi*) and loggerhead (*Caretta caretta*) sea turtles that are known to occur in Galveston Bay. Impacts to listed species are not expected to occur.

Cultural Resources
Only one historic property (41GV151) has been identified to be affected by the proposed project. Channel improvements would cause an adverse effect to site 41GV151 pursuant to 36CFR800.5(a)(1). However, additional surveys are needed to complete inventory and assessment of historic properties for the proposed project.

All areas to be impacted by construction of the proposed Federal project have been surveyed and assessed for historic properties with the exception of the following navigation feature and one section of channel proposed for deepening. An historic properties investigation will need to be conducted on the proposed long shore transport reduction plan located at the end of the Texas City Dike. Sand dredged from the existing Texas City Channel is proposed to be placed on the north side of the Texas City Dike. Two armored groins will be constructed from new work material from the channel bend easing area to aid in reduction of long shore transport of sand material back into the Texas City Channel. A close-order remote-sensing marine survey should be conducted to identify potentially eligible shipwrecks which may be affected by proposed improvements to the Texas City Dike.

The Texas City Channel area adjacent to the remains of the USS *Westfield* will also require survey. This section of the channel was excluded from original remote sensing surveys because it was assumed that the channel bottom had been disturbed regularly by maintenance dredging. However, review of past construction and maintenance contracts revealed that the area has never been dredged. This section of the channel has been scoured by tidal currents over the last 100 years. The section was deeper than authorized project depths when new projects were constructed and, thereafter, was self-maintaining because of the natural scouring. The area will, however, need to be dredged to reach the proposed depth of 45 feet.

Section 106 Compliance. The proposed project will adversely affect the National Register-eligible USS *Westfield* and it is necessary to defer completion of survey, assessment and data recovery until the proposed project is approved and funded. Therefore, the USACE proposes negotiation of a Programmatic Agreement under 36CFR800.14(b) to specify actions which will be taken by USACE prior to or during the project construction period to mitigate adverse effects. In accordance with the Programmatic Agreement, a treatment plan for further investigation and data recovery of the USS *Westfield* has been developed in consultation with the SHPO and U.S. Navy.

Potential to Exceed One Percent of Total Amount Authorized to be appropriated. There is potential for data recovery costs for the proposed Federal project to exceed the one percent cap established by the Archeological and Historic Preservation Act of 1974 (PL 93-291). As soon as practicable, the USACE will determine if a waiver will be sought in accordance with Section 208 of the National Historic Preservation Act Amendments of 1980. Mitigation by avoidance or protection is not possible and data recovery is the recommended option because construction will result in the destruction of USS *Westfield* remains. At this time, it is not possible to determine data recovery costs with certainty because the full area of the USS *Westfield* artifact scatter has not yet been surveyed. For purposes of this feasibility report, cultural resource costs have been estimated at no more than $439,919.

The total estimated Federal cost of the project is $43,991,960 and therefore data recovery costs cannot exceed $439,919 unless a waiver to the one percent limitation is obtained. Activities to research, survey, and evaluate historic properties will not be considered data recovery costs. The project purpose which causes the need for data recovery is navigation, and therefore any costs that exceed the one percent level will be shared by the Federal government and the local sponsor in accordance with the cost sharing formula for navigation features.

When survey and assessment investigations are complete, a data recovery plan will be determined in accordance with the requirements of the Programmatic Agreement and a final cost estimate will be generated. At this time, USACE will determine if a waiver of the one percent limitation will be sought. A letter report with supporting documentation will be prepared which provides a detailed justification for the need to exceed the one percent level. This waiver will be submitted to the USACE Federal Preservation Officer (FPO). After review and HQ coordination of the waiver request, the FPO will submit the waiver request to the Secretary of the Interior for concurrence and Congressional notification.

Commercial and Recreational Navigation

Section 4.2.18 of the EIS contains an exhaustive characterization of the existing commercial and recreational vessel traffic, including vessel encounters and delays, and is incorporated by reference. This information was also used as the baseline for projected vessel traffic after deepening of the Texas City Channel to 45 feet from Shoal Point to the confluence with Bolivar Roads. With the deepened channel, vessel traffic is expected to increase, especially for larger vessels. However, coordination of vessel traffic through the channel with the Port Captain, USCG, and the pilots will minimize vessel delays and safety issues.

Galveston Bay is used extensively by bay commercial fishing vessels and recreational boaters and would be impacted by larger vessels to a certain extent. Deep draft navigation vessels must have right-of-way over small craft for navigation and safety reasons. With increases in deep draft commerce the number of delays and yield to right-of ways experienced by small vessels will increase. However, many of these smaller vessels are not restricted to the dredged channels so the actual limitations should be small and avoidable.

Land Use/Recreation/Aesthetics

Construction of the selected plan will not directly impact adjacent land uses as placement of dredged material in existing PAs will be consistent with existing land uses. The anticipated increase in roadway traffic due to increases in larger vessel traffic is not expected to impact the roadways. The exception is truck traffic on FM 519 between Loop 197 and IH 45, which passes through a commercial and residential area. Secondary support businesses that might occur due to the increase in commerce would be consistent with current land uses.

The Texas City Channel and turning basin is located in a restricted channel and industrial area and should only minimally impact recreational boaters. The proposed project should not interfere with fishing or other recreational activities on the Texas City Dike during placement of dredged material on the north side because this action will be of short duration. It is projected that the addition of material in area 2C will create a beach 100 feet wide and 2000 feet long. The addition of material at the Texas City Dike will actually enhance recreational activities and opportunities with enlargement and stabilization of the beach area. Conversion of bay bottom, to sites that use dredged material beneficially, to create habitat for different species could ultimately create additional opportunities for birdwatchers and anglers.

The most valuable aesthetic views identified in the EIS in association with the channel deepening are from the Texas City Dike, First Ladies Pavilion, Skyline Road and the Thomas S. Mackey

Nature Center. The views from these locations are not expected to dramatically change due to the proposed project. PAs where new habitat has developed would attract naturalists who value viewing wildlife.

Socioeconomics

Significant socioeconomic factors realized through the implementation of this project were documented in the Shoal Point Container Terminal EIS (Section 4.2.20). Factors expected to experience positive change are population, community values, housing, employment, construction, household income, and property values. Construction of the selected plan will increase the availability of jobs for the duration of construction. The increase in workers is expected to create an increase in temporary housing needs and boost local tax revenue. A review of environmental justice data indicates the average percent of minorities and low-income populations in the vicinity of the Texas City Channel are generally lower than the county average. The exception is a slight increase over the county average of minorities categorized as “other races”. Deepening the channel and turning basin is not expected to adversely impact property values in the vicinity of the channel and port. Socioeconomic studies also indicate local property values are expected to decline with or without construction of the deepened channel. No adverse EJ impacts were identified as a result of the proposed project.

9.3 SUMMARY OF IMPACTS

Deepening the Texas City Channel to 45 feet was one of the components of the Shoal Point Container Terminal Project (USACE Permit No. 21979) and was addressed in the November 2002 EIS. The EIS disclosed all environmental impacts associated with the proposed channel deepening for the permit action. The deepening impacts for the permit action are the same for the current Federal proposal to deepen the channel to 45 feet and the proposed action was coordinated with the resource agencies to minimize and avoid adverse impacts. Impacts of the Texas City Channel Deepening Project that have not previously been proposed and coordinated in other projects are deepening the existing Turning Basin, and construction of two groins on the north side of the Texas City Dike that will form the new 75-acre PA 2C to contain dredged maintenance material. These impacts are fully disclosed and evaluated in this document. In addition, any environmental or regulatory changes that occurred since the completion of the November 2002 EIS have been considered.

10.0 CUMULATIVE IMPACTS AND OTHER RELATED ANALYSES

10.1 CUMULATIVE EFFECTS

An extensive cumulative effects analysis conducted for the EIS (Section 4.8) included Galveston, Harris, and Chambers Counties and is summarized in this section. Air and traffic analysis focused on the HGB, which includes an eight county area comprised of Galveston, Harris, Chambers, Brazoria, Fort Bend, Montgomery, Waller and Liberty Counties). Other analyses focused on Galveston, Chambers and Liberty Counties. Past, present and future development in the Area of Impact (AOI) had both adverse and beneficial cumulative effects. Potential adverse effects include loss of bay bottom habitat and air and water quality impacts. Beneficial effects of development in the AOI include conversion of bay bottom to emergent marsh, new economic opportunities, employment opportunities, and recreational resources. Additional housing, infrastructure, and commercial and public land uses required to serve the projected population would result in continued development in the region. As development continues, transportation improvements would be needed. The conversion of natural wildlife habitat and agricultural lands into commercial, residential or industrial land uses would continue to disrupt and disperse fish and wildlife populations. The loss of wetlands in the area would continue to affect natural resources. Development of sites that can be used beneficially for the environment should preserve, restore, and create habitat to ensure the ecosystem's sustainability. Although dredging would affect water quality, the impacts would be temporary and localized. Use of best management practices and spill prevention measures should result in minimal adverse impacts to water quality and aquatic resources in the AOI. Increased development in the HGB is likely to contribute to additional and varying amounts of air pollution emissions. Emission control measures proposed in the SIP are expected to significantly reduce emissions of ozone precursors in the HGB. TCEQ also has regulations in place to control emissions of other pollutants, reducing the potential impact.

The many projects occurring in the general vicinity of the Texas City Channel project are part of the continued urbanization and industrialization of Harris, Galveston and Chambers Counties. The potential cumulative effects of these projects accompany this trend and will affect environmental, social and economic receptors. Potential impacts related to the construction of the Texas City Channel project to the many projects occurring in the AOI would be controlled by governmental regulations and the goals and coordination of community planning efforts. These entities serve to safeguard resources and avoid or minimize negative impacts that adversely affect the general health and sustainability of the region.

10.2 PAST, PRESENT AND FUTURE ACTIONS

Activities in Harris, Galveston and Chambers Counties requiring permits from both the TxGLO and the USACE were considered as part of the cumulative effects evaluation the Shoal Point Container Terminal EIS. The largest categories of TxGLO permitted activities include construction, maintenance or removal of marine structures, pipeline installation, maintenance or removal of pipelines, habitat creation, shoreline stabilization and transportation projects. Currently, there are over 3,200 TxGLO easements in the 3-county area. USACE permitted activities exceed 2,500 permits for the 3-county area and primarily pertain to marine structures, dredge/fill, shoreline stabilization, pipelines, bulkheads, stormwater, wells/drilling and transportation. Further discussion is found in section 4.8.7 of the EIS. Specific actions that may contribute to overall cumulative effects in the area were discussed in Section 4.8.11 of the EIS and include the following projects:

- Modifications to SH 146, SH 3 and IH 45
- Proposed SH 87 Bolivar
- Grand Parkway
- 2022 Metropolitan Transportation Plan (MTP)
- Transportation Improvement Plan (TIP)
- Burlington Northern and Santa Fe Railway Bayport Loop Buildout
- Port of Houston Authority (PHA) Bayport Container Terminal
- Cedar Crossing Industrial Park
- American Acryl Property
- Houston/Galveston Navigation Channels Project
- Texas City "Y" – Modifications to Texas City Channel and GIWW Intersection
- Texas City Channel Federal Project

10.3 CONCLUSIONS

Adverse impacts on natural resources in the region have resulted from general trends in population growth and economic development. Such effects are expected to continue to occur from development related to normal growth in the region. These impacts, and impacts resulting from the proposed action, combine and interact to result in cumulative effects upon the project area. Potentially adverse cumulative effects associated with past and continued future development of the project are loss of habitat, air and water quality impacts, and conversion of land uses. General beneficial effects of development in the region include new economic opportunities, housing alternatives, employment opportunities and recreational resources.

Additional housing, infrastructure, and commercial and public land uses required to serve the projected population, with or without the project, would result in continued development and land use changes in the region. Extensive residential development is proposed in many of the communities in the project area. Restaurants, retail shops, marinas, office complexes, business parks, and convenience stores are among the commercial developments currently being designed or constructed. The need for additional infrastructure and services increases as development occurs (schools, transportation, utilities, fire, police, and emergency medical services). Transportation improvement projects in the region include highway, road, bridge, or overpass construction, reconstruction, widening, or upgrades to accommodate current and projected traffic in the area. Residential, commercial, office and industrial types of development would be accompanied by increased economic opportunity and area employment.

Development impacts associated with normal growth in the region are expected to result in conversion of wetland, riparian, and upland habitats and agricultural lands into commercial, residential or industrial land uses, as well as additional infrastructure and services as people continue to move into the area. Habitat fragmentation from infrastructure construction or changes in land use have disrupted and dispersed fish and wildlife populations. Both natural and artificial processes, including historical, human-induced subsidence and relative sea level rise as well as draining and filling wetlands for development have resulted in the conversion of wetland habitats to open water or upland habitat. However, some losses have been partly offset by gains in emergent wetlands that took place in transitional areas peripheral to wetlands (related to subsidence or water management programs). Although there have been significant losses to wetlands and other habitats since the 1950s and the continued urbanization and industrialization of the Houston-Galveston area will cause continued pressure on these habitats and the ecosystem, efforts to preserve, restore and create valuable habitat are underway that should ensure the ecosystem's sustainability despite continuing pressure of development of the region. The use of dredged material beneficially in Galveston Bay should aid in this effort by creating emergent wetlands to support plant growth, fisheries, and wildlife. There will be no impacts to wetlands and protected species.

Although historical water quality problems have been concentrated in the western urban tributaries, Galveston Bay has maintained good water quality overall. Water quality effects of dredging activities throughout the project area would result primarily from turbidity associated with dredging activities; however, these impacts tend to be temporary and localized. Various existing and planned developments in the area have a potential cumulative water quality impact on the receiving water bodies due to wastewater discharges and urban runoff. Use of best management practices for controlling runoff and thereby limiting potential contamination of the open bay habitat, and spill prevention and control measures for minimizing impacts of accidental spills should result in minimal adverse impacts to water quality and aquatic resources.

As the HGB continues to experience growth in the regional population and economy, the resulting increases in traffic and industrial capacity would be expected to contribute to additional and varying amounts of air pollution emissions. Within the HGB Quality Control Region, ozone is the only criteria pollutant for which the region fails to meet the NAAQS. Even with increased growth in the area, historical ambient air monitoring data for the HGB indicates a long-term downward trend in ozone (HGBAC, 2000). This is generally the result of efforts made to reduce emissions from various sources of VOCs. Under current regulations, the HGB has until 2007 to attain the NAAQS for ozone. The TCEQ has the responsibility for developing the SIP for attaining the air quality standard in the HGB. The SIP sets emissions budgets for point sources, area wide sources, off-road mobile sources, and on-road sources. The emission control measures proposed in the December 2000 SIP revisions are expected to significantly reduce emissions of ozone precursors and provide attainment. In addition, reductions are also expected from expansion or improvement of high occupancy vehicle lanes, traffic flow management, park-and-ride lots, public transportation, and rideshare programs. Emissions reductions consider the need to offset a potential increase in emissions due to growth in the region resulting in increased traffic and industrial capacity.

In addition to the control of emissions to facilitate attainment of the ozone standard, the TCEQ also has regulations in place to control emissions of other pollutants, even though the NAAQS for these pollutants is being met. These regulations affect sources of particulate matter, SO_2, hazardous air pollutants, and other air emissions from industrial facilities and are designed to provide for growth in a way that will continue attainment of the standards.

Air emissions from the proposed action added to other past, present and reasonably foreseeable future actions would be addressed by the regulatory framework described above. The TCEQ and EPA are responsible for monitoring and tracking air quality levels and the identification of potential air quality exceedances. Adjustments will be made to the SIP, as appropriate, to achieve and maintain continued attainment of the standards. In addition, within the HGB, industrial, community, and municipal groups are working cooperatively with the regulatory agencies to identify ways to continue to reduce emissions while allowing for growth in the area.

In conclusion, the many projects occurring in the general vicinity of the proposed Texas City Channel Deepening Project are part of the continued urbanization and industrialization of Harris, Chambers and Galveston counties. The potential cumulative effects of these projects accompany this trend and will affect environmental, social, and economic receptors. However, existing governmental regulations, in conjunction with the goals and coordination of community planning efforts, address the many and varied issues that influence the local and ecosystem-level conditions. The vision, goals and, ultimately, the coordination of the numerous stakeholder groups by local organizations, and the regulatory powers of State and Federal programs in addition to regulations such as the TCMP, the CWA, and the CAA, serve to safeguard these resources and prevent or minimize negative impacts that would threaten the general health and sustainability of the region.

11.0 RECOMMENDED PLAN, COMPARISON TO AUTHORIZED PLAN AND PLAN IMPLEMENTATION

11.1 OVERVIEW

Based on the economic, engineering and environmental factors considered, the recommended plan includes deepening of the Texas City Turning Basin and Texas City Channel from the Turning Basin to the channel junction with the HSC to -45-foot MLT. The work is estimated to begin in 2008 and be complete by 2010.

11.2 RECOMMENDED PLAN

The recommended plan is also the locally preferred plan of dredging the Texas City Channel, including the Turning Basin to its intersection with the HSC, to a depth of 45-feet. Incidental widening for easing a bend and making the channel more linear is necessary between Station 19+339.69 to Station 21+716.78, so that ships can navigate the bend more easily. Two secondary hydraulic-fill finger groins will be added to the north side of the dike near its eastern tip for the purpose of retaining of maintenance material when it is placed behind the groins, thereby preserving and even building-up the beach areas. Deepening and incidental widening of the Texas City Channel and Turning Basin will generate approximately 4.8 mcy of new work material and 43.6 mcy of maintenance material over the 50 year period of economic evaluation. Three foot advanced maintenance dredging for maintenance of the turning basin and channel is proposed. A one foot over-depth dredging tolerance for the turning basin and 2 feet of over-depth dredging tolerance for the main channel is proposed, as is the current practice. All dredged material will be placed into six semi-confined open water PAs, SPPA 1 thru 5 and Pelican Island PA, two reconfigured upland PAs on Shoal Point, PA5 and PA6, and two existing and one new open-water PAs on the north side of the Texas City dike.

The recommended plan is not the NED Plan. The NED Plan is the currently authorized, but not constructed, channel depth of 50 feet. ER 1105-2-100 indicates that if a Non-Federal Sponsor may not be able to afford or support the NED, projects may deviate from it. In this case, the Non-Federal Sponsor requested that the channel depth be increased to 45 feet, not 50 feet, primarily due to the cost. Table 24 presents the economic summary data for the recommended plan. (The economic analysis outlined in Table 24 was prepared using a $1.119 cost per standard gallon for fuel costs. This method of preparing the costs followed a USACE Headquarters (HQUSACE) guidance memo which is attached in Appendix H. Further information on utilizing this cost per gallon is discussed in Section 11.3).

Table 24
Plan Summary Data (March 2006) at 4.875 %

($1.119 per gal fuel cost)

Channel Depth (ft):	45-foot
First Cost of Construction	$ 52,652,000
Interest During 2-Year Construction Period	$2,535,000
Non-Federal Associated Cost	$2,581,000
Archaeology Mitigation Cost	$1,108,000
Total Project Construction Cost	$58,876,000
Average Annual Construction Cost	$3,163,000
Average Annual O&M Incremental Cost	$139,000
Total Average Annual Cost	$3,302,000
Average Annual Benefits	$20,822,000
Net Excess Benefits	$17,520,000
BCR	6.3

11.3 DIVISION OF PLAN RESPONSIBILITIES/COST SHARING REQUIREMENTS

The project cost for determining the cost sharing requirements is based on the fully funded cost estimate. This differs from the cost estimate that was utilized for the economic analysis that determined project benefits and the BCR. This fully funded estimate utilized a current fuel market cost of $2.05 per standard gallon. A $1.119 cost per standard gallon was utilized in the economic analyses. This method of preparing the costs followed a HQUSACE guidance memo which is attached in Appendix H. Further information is below:

Recently, for purposes of economic analysis, estimation of fuel costs for dredge plant operation relied upon immediate-term or current spot market prices. The estimation of fuel costs for cargo vessel operations is based on a five-year moving average. The differing approaches to estimation are based on the assumption or principle that dredge plant costs are expected to be incurred in the relative near future, when a justified project is constructed, while cargo vessel operations costs are expected to be incurred during the project economic life (normally 50 years). In the latter case, the moving average is intended to smooth or reduce short-term or temporary spikes or market fluctuations in bunker costs for constant dollar price estimates applied for present valuation of project benefit streams over the project economic life. Based on this logic, dredge plant and cargo vessel bunkerage costs will almost certainly be different but the margin between the estimates is usually not so pronounced as with the volatility exhibited in the energy markets over this past year (2005-2006).

HQUSACE and the Institute for Water Resources, developed a price adjustment applicable to existing estimates of inland vessel bunkerage costs for approximation of deep-draft or coastal dredge plant costs. What resulted is the recommended estimate of $1.119 per standard gallon for estimation of dredge bunkerage costs for the economic analyses. The current market costs should be utilized for the development of the fully funded project cost estimate. The $2.05 per standard gallon fuel cost was used in developing costs for Tables 25 and 26.

Two costs were developed for evaluation of the selected plan. These costs include the Project Cost (First Cost of Construction) and Fully Funded Cost. Project Cost is the cost at current levels and does not include expected interest during construction, or expected price escalation totals. Project Cost for all project components is $54,490,000. This total, as well as interest during construction, total average annual costs, and non-Federal associated costs are indicated in Table 25.

Table 25
Project Cost Summary for the Selected Plan at 4.875%
($2.05 per gal fuel cost)

First Cost of Construction	$54,490,000
Interest During 2-Year Construction Period	$2,624,000
Non-Federal Associated Cost	$2,683,000
Cultural Resource Compliance Cost	$1,108,000
Total Project Construction Cost	$60,905,000
Average Annual Construction Cost	$3,272,000
Average Annual O&M Incremental Cost	$139,000
Total Average Annual Cost	$3,411,000

Project Costs and price escalation (calculated by estimating the mid-point of the proposed contracts) are combined to create the Fully Funded Cost. The Fully Funded Cost for all project components are separated into expected non-Federal (25%) and Federal (75%) cost shares and detailed in Table 26. The $4,494,500 cost for the preparation of the GRR is not included in Table 26. The sponsor is aware the cost for preparation of the GRR will be included in the construction costs and shared at a 25% - 75% split.

Table 26
Texas City Channel 45-Foot Project Fully Funded Cost Allocation

General Navigation Features (GNF)	Non-Fed Costs (25%)	Federal Costs (75%)	Total Costs
Channel Deepening and Widening	$ 8,081,000	$24,244,000	$32,325,000
Placement Areas	$ 4,800,000	$14,399,000	$19,199,000
Cultural Resource Compliance Cost	$ 167,000	$ 938,000	$ 1,108,000
Engineering & Design	$ 626,000	$ 1,880,000	$ 2,506,000
Construction Management	$ 423,000	$ 1,268,000	$ 1,691,000
General Items (navigation aids, bond cost)	$ 414,000	$ 1,243,000	$ 1,657,000
Fully Funded Total (GNF)	$14,514,000	$43,972,000	$58,486,000

Section 101 of Public Law 99-662 requires on each of the project components the Non-Federal Sponsor will be responsible for payment of 10 percent of the GNF costs (minus costs for lands, easements, rights-of-way and relocation (LERR)) due within 30 years of the completion of the project. This project has no LERR costs or costs for removal of pipelines. Other associated project costs include a non-Federal cost of $2,683,000 for the dredging of private docks (an estimated 268,300 cy @ $10.00 per cy). Associated costs for dredging the berthing areas do not include expected Operations & Maintenance (O&M) costs for those areas. The costs associated with providing additional capacity in PAs to accommodate O&M material dredged from berthing areas is a 100 percent Non-Federal Sponsor cost. Expected cost sharing for all project components is compliant with PGL 47, Cost Sharing for Dredged Material Disposal Facilities and Dredged Material Disposal Facility Partnerships.

The maintenance of the project features will be funded through annual appropriations of the Operations and Maintenance program. Construction General funding will fund all project construction components. The actual amounts would vary on a year-to-year basis because of variability in the volume of material removed during each dredging cycle and the variability of the cycles.

11.4 COMPARISONS TO AUTHORIZED PLAN

11.4.1 Funding Since Authorization

Table 27

Funding History of Texas City (GI-PED)

FY	Amount ($000)	Cumulative Amount ($000)
FY 86	287.0	287.0
FY 87	800.0	1,087.0
FY 88	550.0	1,637.0
FY 89	169.5	1,806.5
FY 97	25.0	1,831.5
FY 02	157.0	1,988.5
FY 03	375.5	2,364.0
FY 04	454.0	2,818.0
FY 05	986.0	3,804.0
FY 06	894.0	4,698.0

11.4.2 Changes in Scope of Authorized Project

Work authorized, but not constructed, by WRDA 1986 included deepening the Texas City Turning Basin to 50 feet, enlarging the 6.7-mile long Texas City Channel to 50 feet by 600 feet, deepening the Bolivar Roads Channel and Inner Bar Channel to 50 feet, deepening the Outer Bar and Galveston Entrance Channels to 52 feet, and extending the Galveston Entrance Channel to a 52-foot depth for 4.1 miles at a width of 800 feet and an additional reach at a width of 600 feet to the 52-foot contour in the Gulf of Mexico. Establishment of 600 acres of wetland and development of water-oriented recreational facilities on a 90-acre enlargement of the Texas City Dike were also authorized but never constructed because the Non-Federal sponsor, the City of Texas City was unable to secure funding to initiate plans and specifications in 1989. In this case, the Non-Federal Sponsor requested that the channel depth be decreased to 45 feet, not 50 feet, and the width remain 400-foot primarily due to the cost. Deepening and widening of the Houston/Galveston Ship Channel addressed the requested channel to the Gulf of Mexico.

11.4.3 Changes in Project Purpose

The primary purpose of the Texas City Channel project has not changed, improving the navigational efficiency and safety of the existing waterway for movement of commerce is still the primary purpose of the project.

11.4.4 Changes in Local Cooperation Requirements

Currently no changes in the local cooperation requirement exist.

11.4.5 Change in Location of Project

Project location remains unchanged.

11.4.6 Design Changes

In 2001, the City requested deepening the channel to 45 feet to accommodate commerce demand. The City did not request deepening the channel to the authorized depth of 50 feet due to potential high project costs and environmental concerns.

11.4.7 Changes in Cost Allocation

There are no changes in cost allocation for project purposes between the authorized project and the recommended plan.

11.4.8 Changes in Cost Apportionment

The non-Federal costs for the authorized project are $50,000,000 and the Federal costs are $150,000,000. The non-Federal costs for the recommended plan are $14,514,000 and the Federal costs are $43,972,000.

12.0 PUBLIC INVOLVEMENT, REVIEW AND CONSULTATION

12.1 OVERVIEW

Public input is important in the overall planning process to assure that plans considered and developed are compatible with community and regional objectives. The primary purposes of public involvement are: 1) to allow the public the opportunity to provide timely information to USACE so that developed plans will reflect their preferences to the greatest extent possible and 2) to provide a method by which USACE can inform the public so that those who choose to participate in the project formulation and the planning process can do so with a relatively complete understanding about the issues, opportunities and consequences associated with a study.

The following are a list of preparers of the Texas City Channel Deepening Project General Revaluation Report and Supplemental Environmental Assessment:

NAME	DEGREE	PROFESSIONAL DISCIPLINE	YEARS OF EXPERIENCE
Sharon Tirpak	B.S. Marine Biology	Project Manager	26.5
Jake Walsdorf	Landscape Architecture	Landscape Architecture	20
Kristy Morten	B.S. Biology	Environmental Specialist	28
Nicole Minnichbach	M.S. Anthropology	Staff Archeologist	19
Gloria Appell	M. S. Economics	Economics	26
Clark Colquitt	B.S. Civil Engineering	Coastal Engineer	30
Tim Few	B.S. Civil Engineering	Civil Engineer, Geotechnical	28
Jon Plymale	B.S. Civil Engineering	Design Project Engineer	27
Brenda Hayden	B.S. Mechanical Engineering	Civil Engineer, General Engineering	20
Ishaq Syed	B.S. Civil Engineering	Hydraulic Engineer	35

12.2 PUBLIC VIEWS AND RESPONSES

A Public Scoping Meeting was held on June 22, 2004, to provide the public with an opportunity to present their views, opinions and recommendations concerning the Texas City Channel General Reevaluation Study. The meeting was also held to help USACE and the City of Texas City identify environmental concerns, study efforts and meet the NEPA requirements for preparing an Environmental Assessment

The following is a list of the main concerns, problem areas or support expressed in the meeting:

- Encourage the beneficial use of dredged material for the construction of artificial bird islands within the project site and including the Swan Lake area (located south and west of the project site).

- Expression of support for the proposed deepening to -45 feet.

In June 2005 a meeting was held with the Texas City Dike Commission to discuss the proposed groins that are to be placed on the north side of the Dike. The purpose of the groins is to slow down or prevent some sedimentation transport from the north side of the Dike back into the Texas City Channel. The only comment expressed at the meeting was from an adjacent business owner concerned about the loss their business might take due to fishermen fishing off the groins instead of their fishing pier.

12.3 ADDITIONAL REQUIRED COORDINATION

To identify and address any issues associated with the Texas City Channel project the USACE contacted the TCEQ, TXDOT, EPA, USFWS, NMFS, TxGLO and the TPWD, and formally contacted the USFWS and the NMFS. Response letters were received from the NMFS and the USFWS (Appendix E). Interagency work groups were formed to address issues associated with the Shoal Point Container Terminal project, which included the Texas City Channel project. Agency issues and responses are documented in Section 6.3 of the EIS and are incorporated in this EA by reference.

12.4 COMPLIANCE WITH APPLICABLE LAWS

Throughout the course of developing the Shoal Point EIS and the Texas City Channel Deepening Project GRR, a variety of methods were used to acquire agency coordination and consultation. Reference page ES-17 of Texas City's Proposed Shoal Point Container Terminal. This GRR and EA have been prepared to satisfy the requirements of all applicable laws and regulations. The document has been prepared using the USACE regulation, ER 200-2-2, Environmental Quality (CEQ): Procedures for Implementing NEPA, 30 CFR 230) and the CEQ, NEPA regulations (40 CFR Part 1500). The following is a brief discussion of environmental review and consultation requirements applicable to this project:

<u>National Environmental Policy Act.</u> The document has been prepared in accordance with CEQ regulations to aid in complying with NEPA. The environmental, economic, and social consequences of the recommended plan have been analyzed in accordance with the act and presented in the report.

<u>Fish and Wildlife Coordination Act of 1958, as amended.</u> The Recommended Plan has been coordinated with the USFWS, TPWD and other appropriate resource agencies throughout the

reevaluation studies. The USFWS has provided input on the channel deepening and PA plans. The USFWS will prepare a planning aid letter for the study.

Magnuson-Stevens Fishery Conservation and Management Act (Public Law 104-297). The Recommended Plan is expected to be beneficial to EFH. The loss of productive EFH during construction of the PAs will have temporary adverse impacts on adult and juvenile brown and white shrimp and red drum. However, the establishment of bay bottom structure and new emergent marsh areas will benefit these species by creating new intertidal habitat. NMFS recommended conservation measures to ensure minimal impacts to EFH and to insure consistency with the EFH provisions of the Magnuson-Stevens Fishery Conservation and Management Act.

National Historic Preservation Act of 1966, as amended. The effect of the Recommended Plan has been taken into account as required by Section 106 of the Act. Additional marine investigations are being conducted on the USS Westfield and for the proposed PA 2C at the Texas City Dike. The USACE has proposed negotiation of a Programmatic Agreement under 36 C.F.R. 800.14(b) to specify action which will be taken by USACE prior to or during the project construction period to mitigate adverse effects.

Clean Water Act, as amended. Section 404 of the CWA regulates the discharge of dredged or fill material into waters of the United States. A 404(b)(1) evaluation of the proposed activity was prepared and is included in Appendix D. A Section 401 State Water Quality Certification for this action will be obtained to comply with the Act. The proposed plan will include Section 402(p) requirements of the CWA where applicable.

Clean Air Act. The Recommended Plan is expected to be consistent with the Clean Air Act, EPA's General Conformity Rule. A preliminary analysis of air emissions for the Texas City Channel project was done to determine if the construction of the proposed plan would generate NOx and VOCs emissions (ozone precursors) above *de minimis* levels specified in the General Conformity Rules, as established by the Clean Air Act, for the Houston Galveston Non-attainment Area (HGB). The HGB is currently classified as a moderate non-attainment area for ozone under the 8-hour standard. Results of air conformity analysis are presented in Appendix D. Air conformity modeling is being conducted to insure the above conclusion.

Coastal Zone Management Act, As Amended.
A TCMP consistency determination was submitted to the TxGLO during development of the EIS, which included deepening of the Texas City Channel, creation of 999 acres of emergent marsh at the proposed SPPAs 1, 2, 3, 4, 5, and the Pelican Island PA, and continued beach replenishment of areas 2A and 2B (Appendix H of the permit EIS). In September 2002, the TxGLO determined that the permit project was above the TCEQ threshold for referral to the CCC and the consistency determination would be deferred to TCEQ for inclusion in the Section 401 Water Quality Certification. By letter dated 11 April 2003, the TCEQ stated the proposed action is consistent with the TCMP goals and policies.

The only added features of the 45-foot selected plan that have not been coordinated through the 40-foot Texas City Channel project and the Shoal Point Container Terminal EIS, are the construction of two 500 foot long groins on the north side of the Texas City Dike and the use of the proposed beach PA 2C. Consistency is being sought only for these added features.

The Texas City Channel project is located within the TCMP boundary. The project is in compliance with the TCMP; with the exception of the two Texas City Dike groins the Shoal Point Container Terminal project, including the Texas City Channel was found to be consistent with the program. The groins are added by the Federal project to stabilize the PA 2C feature that was added during coordination of the EIS and had received a letter of compliance.

Endangered Species Act, as amended. The USFWS and NMFS were contacted regarding threatened, endangered or proposed species and their critical habitats in the project area. Available information, investigations, and informal consultation with USFWS and NMFS have determined that the proposed construction features and the placement and beneficial uses of dredged materials will not result in impacts to any federally-listed threatened or endangered species.

Marine Mammal Protection Act of 1972. Passed in 1972 and amended through 1997, this act is intended to conserve and protect marine mammals, establish a marine mammal commission, establish the International Dolphin Conservation Program, and establish a Marine Mammal Health and Stranding Response Program. The Recommended Plan is in compliance with this Act.

Noise Control Act. This Act establishes a national policy to promote an environment for all Americans free from noise that jeopardizes their health and welfare. Each Federal agency is required to limit noise emissions to within compliance levels. The Recommended Plan is in compliance with this Act.

Executive Order 11990, Protection of Wetlands. This EO directs Federal agencies to avoid undertaking or assisting in new construction located in wetlands, unless no practical alternative is available. The Recommended Plan will not impact wetlands. Instead, the action will create over 1000 acres of emergent marsh.

EO (Executive Order) 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations. This EO directs Federal agencies to achieve EJ by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies and activities on minority and low income populations. The Recommended Plan will not have disproportionate adverse human health or environmental impacts on minority or low-income population groups within the project area.

Executive Order 13186, Responsibility of Federal Agencies to Protect Migratory Birds. This EO directs Federal agencies to increase their efforts under the Migratory Bird Treaty Act, Bald and Golden Eagle Protection Acts, the Fish and Wildlife Coordination Act, the ESA of 1973, NEPA of 1969 and other pertinent statutes as they pertain to migratory birds to avoid measurably negative take of migratory bird populations. The Recommended Plan has been reviewed for compliance with the EO and is not expected to impact migratory bird populations.

Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA). As amended by SARA of 1986, provides for liability, compensation, cleanup, and emergency response for hazardous substances released into the environment and cleanup of inactive hazardous substances disposal sites. 42 U.S.C. 9620 provides that Federal facilities and agencies must comply with the requirements of CERCLA, including the sale or transfer of real property must include a declaration of the type, quantity and time for which any hazardous substance was stored released or disposed on the property. A survey was conducted for CERCLA material and none was located within the project footprint.

Resource Conservation and Recovery Act (RCRA). This Federal law governs the management and disposal of solid waste. RCRA may impose substantial requirements on Federal projects that manage even small amounts of hazardous waste. A survey was conducted for RCRA material and none was located within the project footprint.

13.0 RECOMMENDATIONS

It is recommended that the existing project for the Texas City Channel, Texas, authorized by Section 201 of the WRDA of 1986, Public Law 99-662, dated November 17, 1986 be modified generally as described in this report as the Recommended Plan, with such modifications as in the discretion of the Chief of Engineers may be advisable, and subject to cost-sharing and financing arrangements satisfactory to the President and the Congress, to provide deep-draft channel improvements to the Texas City Channel for the deepening and continued maintenance.

The project cost of all project components, minus inflation and interest during construction, totals $54,490,000. The total investment cost of all components totals $60,905,000 and includes $54,490,000 in project costs, $2,624,000 in interest during construction for project components, and $2,683,000 in associated costs, and $1,108,000 in mitigation costs. Total average annual costs for the project are $3,411,000. The fully funded cost of the project, which includes project costs and expected escalation, totals $60,900,000. (A $2.05 per standard gallon fuel cost was used for these calculations. See Section 11.0, RECOMMENDED PLAN, COMPARISON TO AUTHORIZED PLAN AND PROJECT IMPLEMENTATION, for further details).

These recommendations are made with the provisions that, prior to implementation of the recommended improvements, the Non-Federal Sponsor shall enter into binding agreements with the Federal government to comply with the following requirements:

For the navigation improvements allocated to the Texas City Channel, the City of Texas City shall:

a. Provide, during the period of construction, a cash contribution equal to the following percentages of the total cost of construction of the general navigation features (which include the construction of land-based and aquatic dredged material disposal facilities that are necessary for the disposal of dredged material required for project construction, operation, and maintenance, and, for which a contract for the Federal facility’s construction or improvement was not awarded on or before October 12, 1996):

1) 10 percent of the costs attributable to dredging to a depth not in excess of 20 feet; plus

2) 25 percent of the costs attributable to dredging to a depth not in excess of 45 feet

b. Pay with interest, over a period not to exceed 30 years following completion of the period of construction of the project, up to an additional 10 percent of the total cost of construction of general navigation features. The value of lands, easements, rights-of-way, and relocations provided by the Non-Federal Sponsor for the general navigation features, described below, may be credited toward this required payment. If the amount of credit exceeds 10 percent of the total cost of construction of the general navigation features, the Non-Federal Sponsor shall not be required to make any contribution under this paragraph, nor shall it be entitled to any refund for the value of lands, easements, rights-of-way, and relocations in excess of 10 percent of the total cost of construction of the general navigation features;

c. Provide all lands, easements, and rights-of-way, and perform or ensure the performance of all relocations determined by the Federal Government to be necessary for the construction, operation, maintenance, repair, replacement, and rehabilitation of the general navigation features (including all lands easements, and rights-of-way, and relocations necessary for dredged material disposal facilities);

d. Accomplish all removals determined necessary by the Federal Government other than those removals specifically assigned to the Federal Government;

e. Provide the non-Federal share of that portion of the costs of mitigation and data recovery activities associated with historic preservation, that are in excess of 1 percent of the total amount authorized to be appropriated for the project, in accordance with the cost sharing provisions of the agreement;

f. Provide, operate, maintain, repair, replace, and rehabilitate, at its own expense, the local service facilities of the Texas City Channel in a manner compatible with the project's authorized purposes and in accordance with applicable Federal and State laws and regulations and any specific directions prescribed by the Federal Government;

g. Do not use Federal funds to meet the Non-Federal Sponsor's share of total project costs unless the Federal granting agency verifies in writing that the expenditure of such funds is authorized;

h. Give the Federal Government a right to enter, at reasonable times and in a reasonable manner, upon property that the Non-Federal Sponsor, now or hereafter, owns or controls for access to the project for the purpose of inspecting, operating, maintaining, repairing, replacing, rehabilitating, or completing the project;

i. Hold and save the United States free from all damages arising from the construction, operation, maintenance, repair, replacement, and rehabilitation of the project, any betterments, and the local service facilities, except for damages due to the fault or negligence of the United States or its contractors;

j. Perform, or cause to be performed, any investigations for hazardous substances that are determined necessary to identify the existence and extent of any hazardous substances regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), Public Law 96-510, as amended (42 U.S.C. 9601-9675), that may exist in, on, or under lands, easements, or rights-of-way that the Federal Government determines to be required for the initial construction, periodic nourishment, operation, and maintenance of the project. However, for lands that the Federal Government determines to be subject to the navigation servitude, only the Federal Government shall perform such investigations unless the Federal Government provides the Non-Federal Sponsor with prior specific written direction, in which case the Non-

Federal Sponsor shall perform such investigations in accordance with such written direction;

k. Assume, as between the Federal Government and the Non-Federal Sponsor, complete financial responsibility for all necessary cleanup and response costs of any CERCLA regulated materials located in, on, or under lands, easements, or rights-of-way that the Federal Government determines to be necessary for the initial construction, periodic nourishment, operation, or maintenance of the project;

l. To the maximum extent practicable, operate, maintain, and repair the project in a manner that will not cause liability to arise under CERCLA;

m. Keep and maintain books, records, documents, and other evidence pertaining to costs and expenses incurred pursuant to the project, for a minimum of 3 years after completion of the accounting for which such books, records, documents, and other evidence is required, to the extent and in such detail as will properly reflect total costs of construction of the Project, and in accordance with the standards for financial management systems set forth in the Uniform Administrative Requirements for Grants and Cooperative Agreements to State and Local Governments at 32 Code of Federal Regulations (CFR) Section 33.20;

n. Comply with Section 221 of Public Law 91-611, Flood Control Act of 1970, as amended (42 U.S.C. 1962d-5), and Section 103 of the Water Resources Development Act of 1986, Public Law 99-662, as amended (33 U.S.C. 2213), which provides that the Secretary of the Army shall not commence the construction of any water resources project or separable element thereof, until the Non-Federal Sponsor has entered into a written agreement to furnish its required cooperation for the project or separable element;

o. Comply with all applicable Federal and State laws and regulations, including, but not limited to, Section 601 of the Civil Rights Act of 1964, Public Law 88-352 (42 U.S.C. 2000d), and Department of Defense Directive 5500.11 issued pursuant thereto, as well as Army Regulation 600-7, entitled "Nondiscrimination on the Basis of Handicap in Programs and Activities Assisted or Conducted by the Department of the Army", and all applicable Federal labor standards and requirements, including but not limited to 40 U.S.C. 3141- 3148 and 40 U.S.C. 3701 – 3708 (revising, codifying and enacting without substantial change the provisions of the Davis-Bacon Act (formerly 40 U.S.C. 276a et seq.), the Contract Work Hours and Safety Standards Act(formerly 40 U.S.C. 327 et seq.) and the Copeland Anti-Kickback Act (formerly 40 U.S.C. 276c et seq.); and,

p. Comply with all applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, Public Law 91-646, as amended (42 U.S.C. 4601-4655), and the Uniform Regulations contained in 49 CFR Part 24, in acquiring lands, easements, and rights-of-way, necessary for the initial construction, periodic nourishment, operation, and maintenance of the project, including those necessary for relocations, borrow materials, and dredged or excavated material disposal, and inform all affected persons of applicable benefits, policies, and procedures in connection with said Act.

Construction of the recommended channel improvement is estimated to take two years to complete. During this period, the Government and the Non-Federal Sponsor shall diligently maintain the projects at their previously authorize dimensions according to the previous cooperation agreement. Maintenance materials that have accumulated in the channel at the time that “before dredging” profiles are taken for construction payment shall be considered as part of the project and cost-shared according to the new cooperation agreement. Any dredging in a construction contract reach after the improvement has been completed and the construction contract closed will be considered to be maintenance materials and cost-shared according to the new agreement.

Those portions of the project for Texas City Channel deepened to 45 feet shall be operated and maintained according to the terms and provisions of the new agreement. All other portions of the existing projects for Texas City Channel shall continue to be operated and maintained according to the existing agreement applicable to each channel segment.

The recommendations contained herein reflect the information available at this time and current Departmental policies governing formulation of individual projects. They do not reflect program and budgeting priorities inherent in the formulation of a National Civil Works construction program or the perspective of higher review levels with in the Executive Branch. Consequently, the recommendations may be modified before they are transmitted to the Congress as proposals for implementation funding.

Date	**David C. Weston** **Colonel, Corps of Engineers** **District Commander**

APPENDIX A

Economic Appendix

This appendix presents the economic benefit analysis for the Texas City Channel Deepening Project Draft General Reevaluation Report (GRR). Per ton transportation costs for channel depth alternatives of 43, 44, 45, and 48 feet were compared with the existing 40-foot channel depth costs. The project benefits were calculated for a 50-year period of analysis using EGM 05-01 deep-draft vessel operating costs and the FY2006 Federal discount rate of 4.875 percent. The first year of the project life is expected to be 2010. The project benefits are based on reductions in transportation costs stemming from more efficient vessel loading and a higher utilization of larger vessels.

The without project condition is defined by a 45-foot project depth from the Gulf of Mexico offshore entrance and inner bar channel to its common junction with the Houston and Texas City channels near Bolivar Roads. The 45-foot authorized project depth to Houston was completed from the offshore entrance through Bolivar Roads and inshore from Bolivar Roads to Boggy Bayou as part of the Houston-Galveston Navigation Project in 2003. Completion of the 45-foot channel to Houston prompted renewed interest by the Texas City project non-Federal sponsor in accelerating construction of a 45-foot project depth to the Texas City inner harbor. The WRDA of 1986 authorized a 50-foot project depth to Texas City. The 1986 authorization provided for 50-foot project depth from the offshore entrance channel through the Texas City inner harbor, but the project was put on hold in 1989 because the non-Federal sponsor was unable to secure construction funding. The non-Federal sponsor's current interest is limited to a project depth of 45 feet.Preliminary economic analysis prepared in January 2005 showed that the 45-foot project alternative represented the NED plan. The purpose of the screening was to determine if the net excess benefits from deepening the existing 40-foot channel to 45 feet exceeded those for channel depth alternatives less than 45 feet. Benefits and costs were estimated for channel depth alternatives of 43, 44, 45, 48, and 50 feet.

For the current study, Texas City's historic traffic was evaluated to identify the percentage of tonnage currently or anticipated to be limited by the constraints of the existing and the without-project future channel dimensions. Within the context of this framework, channel constraints were defined to exist when a percentage of the tonnage associated with a commodity group is currently or anticipated to be transported in vessels that cannot be fully loaded. The historic data clearly showed that a significant share of the vessels used in the transport of crude petroleum could be loaded to depths over 40 feet. In addition, but to a lesser extent, examination of the 1998-03 vessels sizes, loaded drafts, design drafts, and parcel sizes revealed that vessels used to transport petroleum products are constrained by the existing 40-foot channel depth. Detailed analysis of 2001-03 traffic was made for the LRR. Data for earlier periods were included in the analysis as well.

Historical Traffic Base

The Texas City Channel complex contains 34 waterfront facilities. Six large industrial concerns operate and/or jointly operate a total of 15 facilities equipped to handle crude oil and petroleum and chemical products. The location of all facilities serving draft constrained vessels is between miles 5.5 and 6.0 of the channel. There are three facilities that receive crude petroleum; all of which can accommodate tankers in excess of 150,000 DWT. The remaining facilities handle liquid bulk materials and dry cargoes. In 2003, Texas City ranked 9th in the U. S. in tonnage volume, with 61.3 million short tons. Texas City ranked among the top ten U. S. ports for the most recent 4-year period. Texas City's recent total tonnage volumes represent record highs, and comparison of 1991-03 Texas City tonnage with that for the U. S. reveals that Texas City average annual growth rate of 2.8 percent for total deep-draft tonnage is more twice the national average annual growth rate of 1.2 percent. USACE's 2004 records became available after preparation of the draft report and are referenced as footnotes to applicable tables.

Approximately 80 percent of Texas City's 2003 total tonnage of 61.3 million consists of deep-draft ocean-going movements. The remaining 20 percent, a total of 12.6 million short tons, consists of shallow-draft GIWW traffic. Eighty-one percent of 2000-03 crude oil tonnage was shipped in vessels greater than or equal to 90,000 DWT with median design drafts of 45 feet or more. Nearly 75 percent of crude oil tonnage was shipped in vessels with loaded drafts greater than 36 feet, and nearly 90 percent was shipped in vessels with design drafts over 40 feet[4]. Transits generally consist of one-way traffic for deep-draft piloted vessels and two-way traffic for inland waterway tows. Shallow-draft barge traffic moves between Texas City and the GIWW and through to links with other U. S. Gulf Coast ports and the inland waterway system. Inland waterway barge traffic generally moves in 2-3 barge tows. Maximum tow sizes are 1,180 feet long. Approximately 19 percent of Texas GIWW and 11 percent of GIWW total tonnage is linked to Texas City. Table 1 presents Texas City 1990-03 total tonnage and principal deep-draft movements.

[4] U. S. Army Corps of Engineers, Waterborne Commerce of the United States, Navigation Data Center, detailed data files.

Table 1
Texas City Channel Tonnage by Major Commodity Group (1000's of short tons)

	Major Deep-Draft Commodities					Major	Ocean-	
	Crude Oil	Petroleum Products		Chemical Products		Group	Going	Total
Year	Imports	Imports	Exports	Imports	Exports	Total	Total	Tonnage *
1990	25,184	480	1,166	320	618	27,768	34,003	48,071
1991	20,348	326	1,876	195	658	23,403	29,500	43,290
1992	26,435	448	1,181	249	1,101	29,414	29,778	43,104
1993	33,111	291	1,470	386	736	35,994	40,536	53,653
1994	22,863	445	274	275	537	24,394	30,068	44,351
1995	27,781	962	506	1,003	528	30,780	35,607	50,403
1996	31,901	500	1,365	429	890	35,085	41,208	56,394
1997	33,900	639	1,758	442	568	37,307	42,379	56,646
1998	27,958	237	1,633	265	1,149	31,242	37,134	49,477
1999	26,900	791	1,483	191	1,706	31,071	36,376	49,503
2000	34,646	1,519	2,871	519	1,533	41,088	47,797	61,586
2001	38,688	1,382	2,263	261	1,449	44,043	49,985	62,270
2002	32,864	2,326	1,540	451	1,154	38,368	43,524	55,233
2003	38,773	1,254	1,794	157	1,323	43,301	48,697	61,338
2004 a/	42,845	3,175	3,082	189	1,281	50,572	55,509	68,283
	1990-2003 Compound Annual Growth Rates a/							
	3.4%	7.7%	3.4%	-5.3%	6.0%	3.5%	2.8%	1.9%

Source: USACE, Waterborne Commerce of the U. S., Part 3, 1990-04.
a/ CY2004 was obtained after the analysis and generally was not evaluated in detail.
* includes shallow-draft barge tonnage

Petroleum and chemical products, including crude oil, comprise nearly 90 percent of 2003 Texas City's deep-draft total and 71 percent of total tonnage. Crude petroleum consistently dominated total tonnage, experiencing nearly a 40 percent increase from 1991-93 to 2001-03 while maintaining a relatively constant share of 1990-2003 tonnage and presently represent nearly 80 percent of total deep-draft tonnage and 63 percent of combined deep- and shallow-draft total. Aggregated tonnage totals and historical growth rate indicators are displayed in Table 2. Table 2 includes coastwise tonnage. Coastwise traffic primarily consists of petroleum product shipments, with about 10 percent of vessel design drafts over 40 feet. As displayed in Table 2, more than 40 million short tons of crude petroleum and petro-chemicals were transported through Texas City in 2003.

Table 2
Texas City Channel Tonnage (1000's of short tons)
and Growth Rates by Movement Class

Major Deep-Draft Commodities (Crude Oil Imports, Petroleum-Chemical Imports/Exports			Other Ocean-Going		Shallow-Draft	
Year	Tonnage	% Change	Tonnage	% Change	Tonnage	% Change
1990	27,768		6,235		14,068	
1991	23,403	-15.7%	6,097	-2.2%	13,790	-2.0%
1992	29,414	25.7%	364	-94.0%	13,326	-3.4%
1993	35,994	22.4%	4,542	1147.8%	13,117	-1.6%
1994	24,394	-32.2%	5,674	24.9%	14,283	8.9%
1995	30,780	26.2%	4,827	-14.9%	14,796	3.6%
1996	35,085	14.0%	6,123	26.8%	15,186	2.6%
1997	37,307	6.3%	5,072	-17.2%	14,267	-6.1%
1998	31,242	-16.3%	5,892	16.2%	12,343	-13.5%
1999	31,071	-0.5%	5,305	-10.0%	13,127	6.4%
2000	41,088	32.2%	6,709	26.5%	13,789	5.0%
2001	44,043	7.2%	5,942	-11.4%	12,285	-10.9%
2002	38,308	-12.9%	5,216	-13.2%	11,709	-4.7%
2003	43,301	12.9%	5,396	4.7%	12,641	8.0%
1990-2003 Compound Annual Growth Rates						
		3.5%		-1.1%		-0.8%

Source: USACE, Waterborne Commerce of the U. S., Part 3, 1990-03.

Comparison of Texas City 1990-03 tonnage with the U. S. reveals that Texas City average annual growth rate of 2.8 percent for total deep-draft tonnage is over twice the national average annual growth rate of 1.2 percent. Table 3 displays comparison of 1990-2003 national and Texas City statistics. Since 1970, both Texas City and U. S. crude petroleum imports has steadily risen as U. S. crude production has fallen and been replaced by foreign imports of crude. Figure 1 illustrates the changing relationship between U. S. domestic production, foreign imports, and refinery input. The Energy Information Administration (EIA) in its Annual Energy Outlook 2006 is projecting continuing declines in U. S. production over the 2004-30 forecast period, along with steady growth of imports. The EIA shows U. S. crude petroleum production declining from 5.42 million barrels per day in 2004 to 4.57 million barrels day in 2030, with a corresponding average annual compound growth rate of -0.7 percent. Over the same period, Alaskan production is projected to decline at an annual rate of -4.5 percent.

Table 3
U. S. and Texas City Total Deep-Draft Tonnage (1000's of short tons)

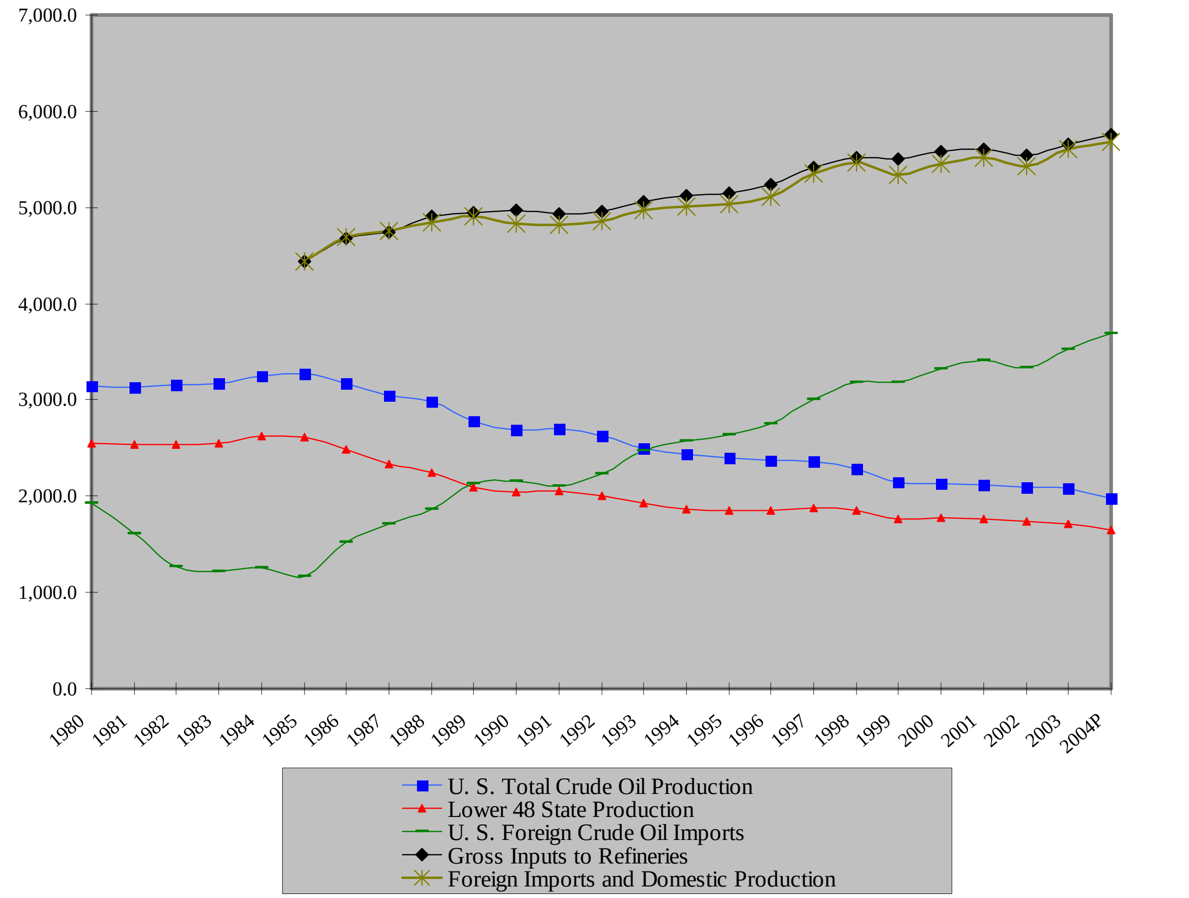
	U. S. Total Deep-Draft Tonnage				**Texas City**	
Year	Foreign Imports & Exports	Coastwise and Lakewise	Deep Draft Total	Annual % Change	Deep-Draft Total	Annual % Change
1990	1,041,556	408,796	1,450,352		34,003	
1991	1,013,557	397,972	1,411,529	-2.7%	29,500	-13.2%
1992	1,037,460	392,529	1,429,989	1.3%	29,778	0.9%
1993	1,060,041	381,571	1,441,612	0.8%	40,536	36.1%
1994	1,115,743	391,806	1,507,549	4.6%	30,068	-25.8%
1995	1,147,357	382,739	1,530,096	1.5%	35,607	18.4%
1996	1,183,386	382,259	1,565,645	2.3%	41,208	15.7%
1997	1,220,616	385,880	1,606,496	2.6%	42,379	2.8%
1998	1,245,388	371,789	1,617,177	0.7%	37,134	-12.4%
1999	1,260,771	342,689	1,603,460	-0.8%	36,376	-2.0%
2000	1,391,826	341,290	1,733,116	8.1%	47,797	31.4%
2001	1,344,086	323,608	1,667,694	-3.8%	49,985	4.6%
2002	1,319,291	317,862	1,637,153	-1.8%	43,524	-12.9%
2003	1,378,115	313,234	1,691,349	3.3%	48,697	11.9%
			1990-2003 Compound Annual Growth Rates			
				1.3%		2.8%

Source for Tables 1-2: USACE, Waterborne Commerce of the U. S., Part 3, 1990-03.

During recent years, 1999-2003, Texas City's recent import trends exhibited higher growth rates than either the nation or the U. S. Gulf Coast Petroleum Administration District (PADD III)[5]. Texas City's 1999-03 average annual growth for crude petroleum imports is 12 percent per annum while U. S. and PADD III respective rates are 3 percent and 1 percent. Comparative rates of growth patterns are illustrated in Figure 2. Table 4 presents a comparison of Texas City crude petroleum import and national and regional rates. Evaluation of Texas City's growth rates for the 1985- and 1990-03 expanded period also reveal long-term growth exceeding national and regional rates. Comparison of Texas City's import growth with Houston showed that crude oil import growth rates were similar between the two ports with the area ports experiencing higher growth than the Gulf Coast region and nation.

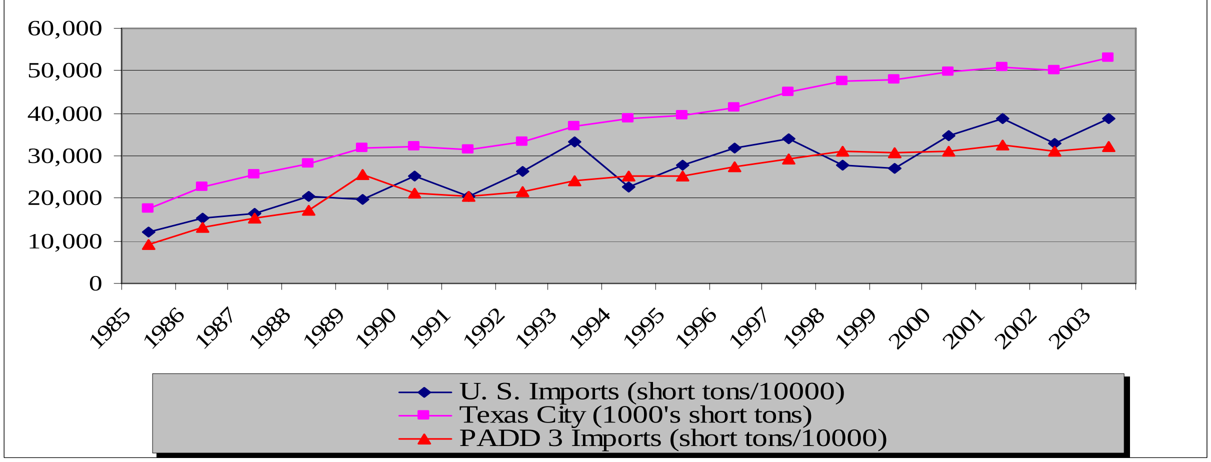
[5] Texas City is contained in Petroleum Administration for Defense District III which includes the states of Texas, Louisiana, Arkansas, Mississippi, Alabama, and New Mexico.

FIGURE 1
U. S. Crude Petroleum Production, Imports, and Refinery Inputs
Barrels in Millions by Year



World production.xls; compiled from EIA website data.

FIGURE 2
U. S. and Texas City Crude Oil Imports
Short Tons



Source: U. S. Army Corps of Engineers, Waterborne Commerce of the U. S. and U. S. Energy Information Administration.

Table 4
Comparison of Texas City and Regional and National Totals
Crude Petroleum Imports (1000's of short tons)

Year	Texas City Imports	PADD 3 Imports	U. S. Total Imports	Texas City Percentage of PAD III	Texas City Percentage of U. S. Total
1985	12,130	90,372	175,095	13.4%	6.9%
1986	15,496	133,107	228,552	11.6%	6.8%
1987	16,312	153,901	255,670	10.6%	6.4%
1988	20,570	172,256	280,112	11.9%	7.3%
1989	19,783	209,622	319,641	9.4%	6.2%
1990	25,184	212,613	322,433	11.8%	7.8%
1991	20,348	203,992	316,310	10.0%	6.4%
1992	26,435	216,745	333,666	12.2%	7.9%
1993	33,111	241,614	371,267	13.7%	8.9%
1994	22,863	251,394	386,381	9.1%	5.9%
1995	27,781	253,200	395,484	11.0%	7.0%
1996	31,901	272,769	411,824	11.7%	7.7%
1997	33,900	292,282	449,961	11.6%	7.5%
1998	27,958	309,147	476,231	9.0%	5.9%
1999	26,900	308,707	477,592	8.7%	5.6%
2000	34,646	312,288	497,547	11.1%	7.0%
2001	38,688	324,094	510,298	11.9%	7.6%
2002	32,897	310,218	499,999	10.6%	6.6%
2003	38,773	323,123	528,703	12.0%	7.3%
2004	42,845	342,238	550,638	12.5%	7.8%

Source: U. S. Army Corps of Engineers and Energy Information Administration.

In terms of total percentage growth, Texas City refined petroleum and chemical products also experienced high growth; however, product totals remain significantly lower than crude petroleum. Combined petroleum and chemical product totals comprise 11 percent of Texas City's total ocean-going movements, up from 9 percent in the early nineties. The 2002 petroleum product import volume of 2.3 million represents a 600 percent increase from 1991-92, with distillate fuel and lube oils contributing to most of the increase. In 2003, product imports dipped to 1.3 million short tons but were over 3 million in 2004 as were product exports, with both import and export levels exhibiting record highs in 2004. Most import growth is attributable to distillate fuel. Overall, Texas City petroleum product import and export totals for 2001-03 are nearly 90 percent higher than 1991-93 levels. Table 5 displays Texas City's 1990, 1995, and 2000-03 commodity specific petroleum product imports and exports. In addition to an increasing volume of petroleum product imports and exports, a steady volume of domestic coastwise product tankers utilize Texas City. Coastwise product tonnage for 1990-03 is included in the "other ocean-going tonnage" column in Table 2.

Table 5
Texas City Channel Petroleum Products 1990-2003 a/
Import and Export Tonnage (1000's of short tons)

	Texas City Petroleum Product Imports						1990 & 1995	2001-2003
Major Group	1990	1995	2000	2001	2002	2003	Avg.	Avg.
Gasoline	33	0	12	5	29	131	17	55
Naphtha & solvents	82	222	191	142	329	193	152	221
Distillate fuel oil	0	235	677	585	1080	740	118	802
Residual fuel oil	222	104	512	505	813	171	163	496
Lube oil	109	221	58	143	72	16	165	77
Petroleum Coke	0	26	0	0	0	0	13	0
Liquid Natural Gas	28	142	68	2	0	0	85	1
Other	6	12	1	0	3	3	9	2
Total Product Imports	480	962	1,519	1,382	2,326	1,254	721	1,654

	Texas City Petroleum Product Exports						1990 & 1995	2001-2003
Major Group	1990	1995	2000	2001	2002	2003	Avg.	Avg.
Petroleum coke	434	274	2029	1205	861	884	354	983
Naphtha & solvents	169	1	32	0	14	359	85	187
Distillate fuel oil	153	50	221	736	257	265	102	419
Residual fuel oil	89	53	392	197	142	123	71	154
Lube oil & greases	16	11	9	3	27	0	14	10
Kerosene	206	0	159	45	0	44	103	30
Gasoline	62	56	24	64	270	119	59	151
Liquid Natural Gas	17	7	4	6	3	0	12	5
Other	20	54	1	7	7	0	37	4
Total Product Exports	1,166	506	2,871	2,263	1,581	1,794	836	1,943

Source: U. S. Army Corps of Engineers, Waterborne Commerce of the U. S., Part 2, 1990-2003.
a/ Product imports for 2004 totaled 3.2 million short tons and exports totals 3.1 million.

Domestic coastwise movements primarily consist of gasoline, distillate, kerosene, and jet fuel. Distribution of 2001-03 coastwise tonnage by major commodity classification is displayed in Table 6. Table 7 presents specific petroleum product group distributions. In 2003, coastwise shipments totaled nearly 4 million. Coastwise receipts were 292 thousand short tons.

Table 6
Texas City Total Coastwise Tonnage and
Distribution of Petroleum and Chemical Product Totals

Major Group	2001	2002	2003
Total Shipments (all commodities)	5,652,592	4,015,857	4,939,504
Total Receipts (all commodities)	199,176	337,384	364,653
Petroleum Product Shipments	4,578,136	3,091,890	3,962,795
Petroleum Product Receipts	173,426	311,877	292,000
Chemical Product Shipments	1,062,456	910,124	976,709
Chemical Product Receipts	25,371	25,507	44,919
Characteristics of Tonnage Transported in Vessels with Design Drafts over 40 feet *			
Short tons	2,201,733	1,380,059	2,218,657
Number of Vessel Movements	54	31	35
Average Parcel Size for Group	40,773	44,500	63,400
Characteristics of Tonnage Transported in Vessels with Loaded Drafts over 36 feet *			
Short tons	1,928,613	712,080	1,828,033
Number of Vessel Movements	45	19	21
Average Parcel Size for Group	42,858	37,478	87,049

* Texas City's tonnage transported in vessels with design drafts over 40 feet almost exclusively of petroleum products outbound shipments
Source: U. S. Army Corps of Engineers, Waterborne Commerce of the U. S., Part 2001-2003.

Table 7
Texas City Total Coastwise Petroleum Products Distribution of Petroleum
By Major Commodity Type (1000's of short tons)

	Petroleum Product Coastwise Receipts						Average	
Major Group	1991	1992	1993	2001	2002	2003	1991-93	2001-03
Gasoline	6	0	24	0	11	67	14%	9%
Distillate Fuel Oil	343	50	7	83	127	225	32%	55%
Residual Fuel Oil	154	90	24	85	161	0	41%	34%
Naphtha & Solvents	33	0	0	0	0	0	2%	0%
Other	154	9	5	5	12	0	12%	2%
Total Receipts	690	149	60	173	311	292	100%	100%
	Petroleum Product Coastwise Shipments						Average	
Major Group	1991	1992	1993	2001	2002	2003	1991-93	2001-03
Gasoline	3,062	2,959	2,625	3,133	2,262	3,000	87%	72%
Distillate Fuel Oil	396	323	192	761	748	850	9%	21%
Residual Fuel Oil	213	15	50	313	62	16	3%	3%
Naphtha & Solvents	46	0	90	0	0	18	1%	0%
Petroleum Coke	0	0	0	101	0	38	0%	1%
Petro. Products Nec.	0	0	0	249	14	20	0%	2%
Other	6	16	0	21	6	21	0%	0%
Total Shipments	3,723	3,313	2,957	4,578	3,092	3,963	100%	100%

Source: U. S. Army Corps of Engineers, Waterborne Commerce of the U. S., Part 1991-2003.

Examination of vessel characteristics and geographic routings suggested that a minimum of 10 percent of outbound coastwise shipment tonnage would benefit from channel depths over 40 feet. The draft-restricted product carriers are generally between the 60,000 and 70,000 DWT with design drafts in the 41 to 43-foot range. While review of the data presented in Table 6 shows that nearly half of petroleum product shipments was shipped in vessels with design drafts over 40 feet, the combination of U. S. tanker availability, depths at trading ports, parcel size demand, and industry discussion suggests that the percentage of tonnage which would utilize channel depths over 40 feet would be closer to 10 percent in the short term increasing to 20 percent over the period of analysis.

Like petroleum products, ocean-going chemical product tonnage increased, with foreign movements increasing and domestic coastwise remaining steady. Chemical import and export tonnage for 2001-03 is 43 percent higher than 1991-93 levels, with all increases attributable to exports. Exports primarily consist of hydrocarbons, acids, and alcohols. In comparison to petroleum products, chemical import tonnage represents half the volume of petroleum products. In 2003, deep-draft exports of chemicals and allied products totaled 1.3 million short tons and imports 157 thousand. Annual imports for recent years total less than 500 thousand short tons. Domestic coastwise chemical movements consist largely of hydrocarbons, acids, and alcohols, with coastwise shipments exceeding receipts. In 2003, coastwise shipments totaled 977 thousand short tons and receipts totaled 45 thousand short tons Table 8 displays Texas City's 1990, 1995, and 2000-03 chemical product imports and exports by major commodity type. Potential benefits for channel depths over 40 feet for chemical carriers were found to be limited based on examination of vessel sizes, load patterns, and discussion with industry. Long-term use of loaded drafts less than 40 feet is expected of the period of analysis.

In addition to deep-draft ocean-going vessel traffic, a substantial volume of inland waterway barges use Texas City, with 2001-03 volumes averaging over 12 million short tons annually. Maximum loaded drafts for inland waterway barges are in the 9- to 12-foot range. Texas City's 2001-03 inland waterway barge traffic by major commodity group is displayed in Table 9. Inland waterway product tonnage for the period 1990-03 is also included in the column labeled "shallow-draft tonnage" in Table 2. The GIWW tonnage forecast released by the Institute for Water Resources shows inland waterway average annual growth rates between 1 and 2 percent for the period between now and 2020; however, during recent years Texas City barge tonnage has remained relatively flat.

Table 8
Texas City Channel Chemical Products
Import and Export Tonnage (1000's of short tons)

	Chemical Product Imports						1990, 1995	2001-03
Major Group	1990	1995	2000	2001	2002	2003	Avg.	Avg.
Fertilizer	0	116	0	20	0	0	58	7
Acyclic Hydrocarbons	29	53	86	50	47	30	41	42
Benzene & Toluene	4	40	55	20	42	6	22	23
Hydrocarbons	5	128	70	34	40	12	67	29
Alcohols	277	373	159	83	191	58	325	111
Other	5	409	149	74	131	51	207	85
Total Imports	320	1003	519	261	451	157	662	290

	Chemical Product Exports						1990, 1995	2001-03
Major Group	1990	1995	2000	2001	2002	2003	Avg.	Avg.
Agric. Fertilizer	378	172	38	0	27	11	275	13
Hydrocarbons	131	123	770	545	608	665	127	606
Alcohols	118	45	177	467	187	158	82	271
Carboxylic Acids	93	48	181	181	168	222	71	190
Nitrogen Func. Comp.	117	63	173	123	46	125	90	98
Organic/Inorganic Compounds	42	31	116	51	43	69	37	54
Other	117	46	40	82	82	62	82	75
Total Exports	996	528	1,495	1,449	1,161	1,312	762	1,307

Source: U. S. Army Corps of Engineers, Waterborne Commerce of the U. S., Part 2, 1990-2003.

Table 9
Texas City Inland Waterway Barge Shallow-Draft Tonnage Texas City to/from Gulf Intracoastal Waterway (GIWW)

Year	Petroleum Products	Chemical Products	Other Commodities	Total Tonnage
	Inland Waterway Barge Shipments (1000’s of short tons)			
2001	5,202	1,548	2	6,752
2002	5,271	1,445	2	6,718
2003	5,052	1,442	386	6,880
	Inland Waterway Barge Receipts (1000’s of short tons)			
2001	2,909	2,273	12	5,194
2002	2,650	1,995	17	4,662
2003	2,866	2,505	12	5,383

Source: U. S. Army Corps of Engineers, Waterborne Commerce of the U. S., Part 2001-2003.

Other Port Development

In addition to its petroleum base, the Port of Texas City was issued a permit for the private development of the Shoal Point Container Terminal in 2004. Initial groundbreaking for the container terminal began early in 2005. For purposes of the Federal project and the LRR analysis, the operation of the container terminal is part of the without project future. As noted in the Shoal Point EIS, the container terminal is proposed to meet regional needs for development of a containerized cargo facility. The impetus for proposed development at Shoal Point is regional needs for additional container capacity within the Texas Central Gulf region, as well as projected growth in the Latin American market.

In terms of general container cargo trends and aside from the Texas City permit action, Texas Gulf Coast container movements increased by 9.0 percent between 2000-03 while West Coast container movements increased by 9.7 percent (Journal of Commerce, May 2004). For 2002-04, Houston's average rate of growth was 10.8 percent, topping the West Coast rate of 10.5 and well exceeding the U. S. and Gulf Coast rates respective rates of 6.8 and 7.4 percent[6]. Global Insight Inc. is forecasting annual growth rates of 3.1 percent between 2000-05 for U. S. seaborne container trade between the U. S. and Mexico and Latin America; 1.7 percent from 2005-10, and 1.4 from 2010 to 2022. Between 1999-03, South and Central America container throughput increased by a total of 35 percent. Analysis of vessel classes or sizes currently employed for container trade along the U.S. Gulf coast suggests that vessels ranging in size from approximately 2,400-3,700 twenty-foot equivalent unit (TEU) capacity would form the most frequent size augmented by vessels of Panamax class with capacities of approximately 3,900 to 4,850 TEUs. Utilization of Post-Panamax vessels is presently low on the Gulf Coast, and while their use is expected to increase in the future, the percentage of cargo utilizing depths over 40 feet is not conclusive.

As previously noted, as with other Gulf coast containerized services, the utilization (both loading and service frequency) of upper class carriers will be influenced prior and post ports of call and considerations of transit time to transit the Gulf. Review of the loading patterns at other U. S. ports suggests that maximum channel depths of 40 to 43 feet may be sufficient based on near future vessel fleet requirements and associated maximum loaded vessel drafts. Additionally, depths of 50 feet or more are limited. The only U. S. container port with channel depth over 50 feet is Los Angeles/Long Beach with a project depth of 53 feet. New York is currently 45 feet and is being dredged to 50 feet. A 50-foot New York Harbor depth is expected to be operational by 2010. The Oakland Harbor container port on the West Coast is 50 feet and Norfolk Harbor on the east coast has a 50-foot outbound depth. Channel depth justifications for these projects required clear demonstration that the existing fleet could readily utilize the increased channel

[6] http://www.aapa-ports.org/pdf/CONTAINER_TRAFFIC_CANADA_US.xls

depth. Based on these considerations, and the large effect of existing petroleum base on depth optimization, deepening benefits were not estimated for container cargo.

Again, for purposes of the current GRR, transportation savings were not calculated for Texas City container cargo. The reasons for not including containers in the channel deepening benefits varied. First, NED transportation savings from the large crude petroleum and petroleum products base is huge in comparison to the anticipated NED benefits associated with containers, in particular for a new facility. The magnitude of transportation cost benefits are particularly high because the offshore entrance channel has already been deepened to 45 feet as part of the Houston-Galveston Navigation Project and the additional cost to dredge the Texas City Channel to depths over 40 feet is comparatively low. Additional considerations for not quantifying container benefits relate to uncertainties associated with the sailing drafts of the container vessels expected to utilize the project at the onset of the planning period. It is well recognized that Texas City has the advantages needed to capture a sizable portion of the Gulf Coast market area; however, the number of vessels that would benefit from channel depths in excess of 40 feet may be limited for the early portion of the economic planning period (2010-2060) given the loaded drafts of containerships circuiting the U. S. Gulf Coast. The need for channel depths in excess of 40 feet is generally limited to the first or last port visited on the foreign inbound or outbound leg of the containership routing itinerary. Quantification of the NED benefits would necessitate inclusion of a multiport analysis as part of the GRR. The remainder of this appendix focuses on Texas City's petroleum base tonnage, associated vessel utilization, refinery capacity, national petroleum import expectations, and quantification of channel deepening benefits for depths over the existing 40-feet.

Petroleum Vessel Fleet Expectations and Project Beneficiaries

Texas City's existing 40-foot project depth was designed to efficiently and safely accommodate vessels of approximately 40,000 DWT with loaded drafts of 36 feet. Since construction of the existing project in 1967, the size and draft of vessels have increased to meet the competitive demand for more efficient movements of bulk commodities, in particular crude petroleum and petroleum products. Examination of the vessel sizes used in the transport of crude petroleum and, to a lesser extent, petroleum products revealed significant transportation savings could be realized from larger vessel loads. For the purposes of this report, project benefits were calculated for crude petroleum imports, petroleum product imports and exports, and coastwise movements of petroleum products transported to docks adjacent to the Texas City Turning Basin[7]. The turning basin section of the Texas City Channel contains six docks that can receive

[7] The issuance of the Shoal Point Container Terminal permit in 2004 and initiation of construction in 2005 will result in the introduction of containerships before the year 2010; however, the introduction of containerships with loaded drafts over 40 feet is not expected to affect plan optimization. The largest concentration of maximum loads for containerships is expected to be near 40 feet.

crude petroleum, four of which can accommodate tankers in excess of 150,000 DWT. These docks receive all of Texas City's crude petroleum import tonnage and draft-constrained product tankers. Initial investigations suggested that a significant percentage of Texas City crude petroleum imports would immediately benefit from the 45-foot depth. Additionally, examination of the vessel sizes used for petroleum product imports and loading patterns at other Gulf Coast ports showed that up to 51 percent of product imports are transported in vessels with loaded drafts over 40 feet. Examination of Texas City's domestic coastwise petroleum product movements revealed that between 10 and 20 percent of domestic coastwise petroleum product tonnage would also be likely to utilize the 45-foot depth. Expectations concerning the relationship between the proposed 45-foot project depths and the percentage of tonnage transitioning to more fully loaded drafts are subject to certain degrees of uncertainty. Some of the major variables affecting utilization are origin of shipment and trade route. Other variables, particularly relevant in the short-term, include vessel availability and vessel operating costs. Minimization of vessel operating costs are, of course, assumed to drive long-term vessel choices. Discussion of the range of commodity specific percentages used for the benefit calculations are presented in the following section.

Crude Petroleum and Energy Demand Indicators

The U. S. Gulf Coast leads the nation in refinery capacity, with 41 percent of U. S. crude oil distillation capacity[8]. Products, such as gasoline, heating oil, diesel, and jet fuel, are transported from the Gulf Coast to the East Coast and the Midwest. One-half of the Gulf Coast refinery capacity is in Texas and the remainder is in Louisiana. Texas City's refinery capacity represents 4.0 percent of the national total and nearly 16 percent of the state total (Table 10). Current capacity is 718,950 barrels per calendar day (BPD), up by approximately 15 percent from 1994. Texas City refinery trends are similar to other U. S. refineries with declines in capacity until the mid-nineties. The EIA notes that falling demand for petroleum and deregulation of the U.S. refining industry in the 1980s led to 13 years of decline in U. S. refinery capacity. The trend toward declining U. S. capacity was reversed to some extent in the mid-1990s, and 1.4 million barrels per day of distillation capacity was added between 1996 and 2003.

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[8] http://www.eia.doe.gov/pub/oil_gas/petroleum/analysis_publications/oil_market_basics/Refining_text.htm
Distillation is the basis of the refining process. Crude oil is made up of a mixture of hydrocarbons, this first and basic refining process is aimed at separating the crude oil into its "fractions," the broad categories of its component hydrocarbons. Crude oil is heated and put into a still, a distillation column, and different products boil off and can be recovered at different temperatures. The lighter products, liquid petroleum gases (LPG), naphtha, and some gasoline are recovered at the lowest temperatures. Middle distillates, such as jet fuel, kerosene, distillates come next. Finally, the heaviest products (residuum or residual fuel oil) are recovered.

Table 10
Texas City Atmospheric Crude Oil Distillation Capacity
and Percentage of State and National Totals

	Texas City Refinery Capacity *		
Capacity as of	Barrels/day	% Texas Total	% U. S.
1-Jan-94	626,500	14.0%	4.2%
1-Jan-99	657,000	15.7%	4.0%
1-Jan-00	661,000	15.6%	4.0%
1-Jan-01	661,000	15.4%	4.0%
1-Jan-02	713,000	15.9%	4.2%
1-Jan-03	724,000	16.7%	4.3%
1-Jan-04	713,000	15.9%	4.2%
1-Jan-05	718,950	15.5%	4.2%

* Texas City's atmospheric crude oil distillation capacity in January 2005 was 718,950 barrels per day, equals approximately 39,455,690 short tons. U. S. capacity was nearly 18 million barrels per day.
Source: U. S. Department of Energy, Energy Information Administration, extracted from detailed files.

Table 11 displays U.S. total annual crude petroleum refinery data for the period 1965-04. The amount of crude petroleum imported into Texas City is dependent upon the area's capacity to refine crude and/or pipeline it to other refining complexes. Evaluation of Texas City's refinery capacity (Table 10) revealed that 2001-03 crude petroleum import volumes represent 96 percent of crude petroleum refining capacity. While this is high margin, the effect of efficiencies through bottle-necking[8], refinery expansion, substitution of imports for declining domestic production, and 30 percent of Texas City's waterborne crude being pipelined out of Texas City provides additional capacity. Two of Texas City's refineries have the additional capacity for 300,000 BPD, and the Texas City to Houston pipelines has over 200,000 BPD additionally capacity. These increases bring Texas City capacity to 1,218 MBD, equating to an annual volume of approximately 67 million tons. Future expectations are for imports to continue serving as a substitute for declining domestic supplies. Figure 3, which shows total PADD3 imports and domestic receipts, including internal production, is representative of how Texas City's petroleum disposition has evolved. For instance between 1995-04, the combined growth rate for the sum of PADD3 foreign imports, domestic production, and internal receipts domestic receipts grew at an average annual rate of 1.1 percent. The 1995-04 average annual growth of 1.1 percent consists of decreases in domestic receipts and PADD3 production and of increases in foreign imports.

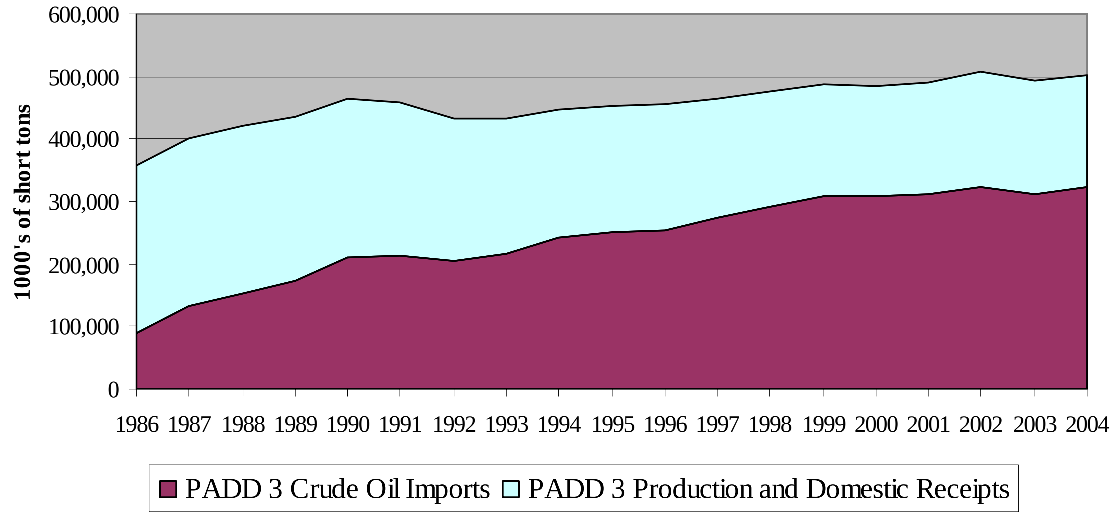
[8] An upgrading procedure which results in the ability to process more crude than the nameplate size of the distillation unit would indicate. In such cases, a refinery is able to achieve a utilization rate greater than 100 percent for short periods of time.

Table 11
United States 1965-1999
Refinery Capacity and Utilization

Year	Number of Operating Refineries	Refinery Capacity Barrels/Day	Gross Input to Distillation Barrels/Day	Operable Refineries Utilization Rate
1965	293	10,419,851	9,535,395	91.5%
1970	276	12,021,273	11,491,018	95.6%
1975	279	14,960,710	12,873,296	86.0%
1980	319	17,988,121	13,802,736	76.7%
1985	223	15,658,769	12,137,936	77.5%
1990	205	15,571,966	13,579,314	87.2%
1991	202	15,675,627	13,477,804	86.0%
1992	199	15,696,155	13,607,175	86.7%
1993	187	15,120,630	13,820,256	91.4%
1994	179	15,034,160	14,000,343	93.1%
1995	175	15,434,280	14,087,230	91.3%
1996	170	15,333,450	14,344,353	93.5%
1997	164	15,451,785	14,804,822	95.8%
1998	163	15,711,000	15,079,207	96.0%
1999	159	16,261,290	15,052,213	92.6%
2000	158	16,511,871	15,312,512	92.6%
2001	155	16,595,371	15,340,367	92.6%
2002	153	16,785,391	15,138,719	90.7%
2003	149	16,757,000	15,508,000	92.6%
2004	149	16,974,000	15,783,000	93.0%
1980-1990 Average	249	16,406,285	13,173,329	80.5%
1991-1997 Average	182	15,392,298	14,020,283	91.1%
1998-2004 Average	155	16,513,703	15,316,288	92.9%

Source: U. S. Department of Energy, Energy Information Administration, Annual Energy Outlook 2004, website data.

FIGURE 3
PADD 3 (U.S. Gulf Coast) Foreign Crude Oil Imports and
PADD 3 Domestic Production Plus Receipts by Pipeline, Tanker, and Barge
1986-2004



As the EIA notes while financial and legal considerations make construction of new refineries unlikely, existing refinery additions are expected in order to accommodate the net effect of higher throughputs[9]. The effect of efficiencies through bottle-necking, refinery expansion and substitution of imports for declining domestic production provides for additional capacity. Overall EIA is forecasting domestic distillation capacity to increase by over 30 percent between 2003 and 2030. In comparison to the 1981 peak of 18.6 million barrels per day, distillation capacity is projected to grow from the 2003 year-end level of 16.8 million barrels per day to 22.3 million barrels per day in 2025 in the reference case, 21.4 million in the high oil price case. Almost all new capacity additions are projected to occur on the Gulf Coast.

U.S. existing refineries will be utilized intensively (92 to 95 percent of operable capacity) throughout the EIA forecast period. The 2003 U. S. refinery utilization rate was 93 percent, well above the lows of 69 percent during the 1980s and even the 88 percent mark during the early 1990s but consistent with capacity utilization rates since the mid-1990s. EIA emphasizes that distillation capacity increases are expected due to improved processing of the intermediate streams obtained from crude distillation and subsequent reductions in residual fuel. Texas City industry personnel confirmed improved processing realizations. The EIA expectation is that the market for residual is shrinking and the improved distillation processing will produce higher value "light products" such as gasoline, distillate, jet fuel, and liquefied petroleum gas. Texas

[9] Energy Information Administration, Annual Energy Outlook 2005, "Market Trends – Natural Gas Demand and Supply", p. 7.

City records for 2000-03 show residual fuel movements relatively low in comparison to distillate, with much of the distillate increase due to temporary taps in heavy crude availability. Texas City distillate imports, as well as exports and coastwise shipments, have exhibited significant growth over the last decade. Foreign exports increased from 147,000 short tons over 1991-93 to 419,000 short tons over 2000-03, and imports grew from less than 100,000 short tons annually to over 800,000 in 2003. Deep-draft coastwise distillate shipments increased from 303,000 short tons over 1991-03 to 790,000 short tons over 2001-03 The EIA also expects that world demand for "light products" will be supplemented by foreign markets, particularly in the Asia/Pacific region. Refinery construction in developing countries is noted to generally necessitate configurations that are more advanced than those currently in operation in the U.S; however, the Texas City refineries have the capability to refine several grades of crude petroleum and this capability has resulted in a large market share. The EIA also noted that foreign refineries will generally need to supply lighter products from crude oils whose quality is anticipated to deteriorate between 2003 and 2030.

While recognizing these trends and associated limitations, both EIA (December 2005) and Global Insight (2005) show imports increasing over the forecast periods. Additionally, exports of refined products are projected to increase but at a more modest rate. Both the EIA and Global Insights provide forecasts of product imports, product forecasts indicators are more general. The EIA is forecasting an average annual growth of 0.4 percent for 2004-30 U. S. product exports. Examination of Texas City's long-term product exports 1985-03 trendline shows general upward movement with average annual growth at 0.6 percent. Furthermore, Global Insight is forecasting average annual growth rates of about 4 percent in income related to exports of industrial materials, which includes petroleum products.

In addition to potential uncertainty due to refinery capacity, the effect of price increases was investigated. An outcome of high oil prices and world stability concerns experienced throughout 2005 demonstrates obvious uncertainty inherent in forecasting crude oil market trends. Crude oil prices in the AEO2006 reference forecast are substantially higher than the January 2005 Annual Energy Outlook 2005 (AEO2005) forecast and are also considerably higher than most other projections (Table 12). Despite EIA's forecast of higher crude oil prices, import volumes are surprisingly similar between forecasts. The AEO2006 release shows average annual growth rates of 0.4 percent for 2004-15 and 1.7 percent for 2015-30. Global Insight shows annual growth of 1 percent for the entire 2004-30 period; EVA (Energy Ventures Analysis, Inc.) show – for 2004-15 and – through 2030; and PIRA (Petroleum Industry Research Associates, Inc) shows –0.4 percent through 2015 with 2015-30 volumes growing at a very modest annual rate of 1.0 percent. Analysis of Texas City's historical trend demonstrates that Texas City is more likely to

Table 12
Comparison of AEO2006 and Alternative Forecasts
World Oil Price and U. S. Crude Oil Imports 2004, 2015 and 2030

		AEO2006			Alternative Forecasts				
		Reference Forecast	High Price	High Growth	Global Insights	Deutsche Bank	Energy Venture Analysis	PIRA Energy Group	Delphi Group
Component / Year	**2004**	**2015**	**2015**	**2015**	**2015**	**2015**	**2015**	**2015**	**2015**
World Oil Price a/	$31.52	$47.79	$76.30	$47.79	$34.06	$31.75	n/a	$49.95	$52.50
Imports Millions Barrels/Day	10.06	10.47	9.68	11.20	11.28	11.74	11.06	9.65	n/a
	2004	**2030**	**2030**	**2030**	**2030**	**2030**	**2030**	**2030**	**2030**
World Oil Price a/	$31.52	$56.97	$95.71	$56.97	$34.50	$31.75	n/a	n/a	$72.50
Imports Millions Barrels/Day	10.06	13.51	11.26	14.98	13.01	n/a	15.51	11.24	n/a

a/ Reflects EIA redefined world oil price path to represent the average U. S. refiners' acquisition price of imported low-sulfur light crude oil. This transition was made after AEO2005 and before AEO2006
Source: EIA 2006 Annual Energy Outlook, Tables 20 and 24. Supplemented with data from Global Insight, Petroleum Supply/Demand Balance, Table 13, September 2005.

experience growth slightly above the national rates and, therefore, is more likely to reflect the EIA or Global Insights at least in the short run.

Uncertainty also relates to oil depletion. The EIA notes in its "Issues in Focus" discussion (January 2005), that while fossil fuels are, no doubt, subject to depletion, increased scarcity and subsequent higher prices, there are many resources that are not heavily exploited. Higher prices, and the inference of profit increases, can be expected to lead to the development of sites and technologies, including production from oil sands, ultra-heavy oils, gas-to-liquids technologies, coal-to-liquids technologies, bio-fuel ultra-heavy oils, gas-to-liquids technologies, coal-to-liquids technologies, bio-fuel technologies, and shale oil. Non-conventional liquid production is noted as a potential buffer against high oil prices. The EIA's January 2005 crude oil import projections show non-conventional liquids production increasing from 1.8 million barrels per day in 2003 to 5.7 million barrels per day by 2025. Additionally, higher prices are noted being a function of inadequate refinery capacity. In turn, current capacity inadequacies are likely tied to years of low oil prices and producers' fear of surpluses. Recent price increases, and expectations of a long-term price plateaus, have boosted interest in investment; however, continuous price increases and unstable supplies could lead to long-term declines in demand and, henceforth, deter investment interest.

Texas City Commodity Projections Overview

Table 13 displays the commodity projections used for Texas City's base line benefit calculations. The AEO2006 reference forecast was used for Texas City's crude petroleum and petroleum product import and exports. The crude petroleum forecast presented in Table 13 incorporates the AEO2006 2003-30 projections into a regression equation estimated using Texas City and U. S. 1975-03 imports. The forecast reflects continuation of Texas City tonnage growing at a faster rate than the U. S. totals until 2030.

Table 13
Texas City Projections for Commodity Groups Used for Benefit Calculations
Totals by Commodity Group (1,000's of short tons)

	Crude Petroleum	Petroleum Products		
Year	**Imports**	**Imports**	**Exports a/**	**Coastwise Shipments**
1999	26,900	791	692	3,687
2000	34,646	1,519	842	5,058
2001	38,688	1,382	1,056	4,590
2002	32,864	2,326	720	3,092
2003	38,773	1,254	910	3,963
2001-03	36,775	1,654	895	3,882
2010	43,680	2,186	966	4,304
2020	53,246	2,842	1,015	4,898
2030	64,351	3,379	1,055	5,573
2040	71,084	4,016	1,096	6,341
2050	78,520	4,775	1,138	7,215
2060	86,735	5,677	1,183	8,210
	Average Annual Tonnage Growth Rate (2001/03 to 2030)			
	2.0%	2.7%	0.6%	1.3%
	Average Annual Tonnage Growth Rate (2030-60)			
	1.0%	1.7%	0.4%	1.3%
	Average Annual Tonnage Growth Rate (2001/03-60)			
	1.1%	2.1%	0.5%	1.3%
	Short Tons of Cargo Used for Benefit Calculations			
	Crude Petroleum	**Petroleum Products**		
Year	**Imports**	**Imports**	**Exports a/**	**Coastwise Shipments**
2010	34,944	895	145	430
2020	42,597	1,164	152	980
2030	51,481	1,383	158	1,115
2040	56,867	1,644	164	1,268
2050	62,816	1,955	171	1,443
2060	69,388	2,324	177	1,642

a/ Excludes petroleum coke. Petroleum coke is exported from an area not in the 45-foot reach.

Source: U. S. Department of Energy, Energy Information Administration, 2006 Annual Energy Outlook, December 2005 application

Texas City's long-term growth expectations, in particular post-2030, are assumed to be more reflective of the EIA and Global Insight projected trendlines. Texas City's product forecasts are based on direct application of the AEO2006 growth rates using Texas City's 2001-03 average product volumes as a base. The domestic coastwise petroleum product shipment forecast was prepared based on extrapolation of Texas City's recent historical trends with an average annual growth rate of 1.3 percent anticipated for 2010-60. Discussions of the commodity forecast bases and sensitivities are discussed in the sections that follow.

Crude Petroleum Imports Forecast Methodology

Determination of the general forecast methodology and regression equation used for the crude oil forecast was based on the relative magnitude of the R squared values, the significance of the t-value and F statistic, and the smallest standard error of the y coefficient. Table 14 displays the regression equation output found to reasonably well validate applicability of national forecast indicators.

Table 14
Regression Equation Output for
Texas City Crude Oil Imports a/

Component	Description of Data and Outputs
Dependent Variable	TC Crude Imports (1975-03)
Independent Variables	U. S. Crude Imports and Year
Constant	-1,540,258
Std Err of Y Estimate	3,029.90
Adjusted R Square	0.8992
No. of Observations	29
Degrees of Freedom	2
X Coefficient: U. S. Crude Oil Imports	0.0040
X Coefficient Level of Significance of t value	0.99999
X Coefficient: Year	780.68
X Coefficient Level of Significance of t value	0.9961
F Statistic	125.93
Significance of F statistic	0.99999

a/ Texas City 2010 Imports = -1,540,258 + (780.68* 2010) + (.004 * 3,677,426); with 3,677,426 being U.S. imports in 2010.

Other variables, principally Lower 48 state production, were also examined; however, U. S. import levels generated relatively stronger statistic indicators. For comparison, Global Insight's (September 2005) forecast previously displayed in Table 12 was used. Table 15 presents the Texas City application for the EIA and Global Insight 2001-2030 forecasts. The EIA reference forecast was used to calculate the baseline benefit calculations and the EIA import volumes were used. Global Insight's forecast was evaluated as one of several sensitivities.

Table 15
Texas City Crude Petroleum Imports (1000's of short tons)
Application of U. S. Department of Energy 2003-25 and
Global Insight 2003-30 Forecasts

Year	Base Application Estimated Value	Application of One Standard Error			Average Annual Growth Rate
Texas City Imports with U. S. Department of Energy Application (2003-30)					
2001-03	37,121 a/	34,091	To	40,151	
2010	43,680	40,115	To	47,245	2.1%
2020	53,246	48,900	To	57,592	2.0%
2025	58,718	53,925	To	63,510	2.0%
2030	64,351	59,098	To	69,603	1.8%
Texas City Imports Global Insight Application (2003-30)					
2001-03	37,121 a/	34,091	To	40,151	
2010	44,599	40,959	To	48,239	2.3%
2020	54,097	49,682	To	58,513	1.9%
2025	59,014	54,197	To	63,831	1.8%
2030	63,594	58,404	To	68,785	1.5%

a/ The 2001-03 value of 37,121 thousand short tons was estimated using the regression equation. Actual 2001-03 average was 36,775 thousand

Source: U. S. Department of Energy, Energy Information Administration, December 2005, and Global Insight, Petroleum Supply/Demand Balance, Table 13, September 2005.

Crude Petroleum Fleet

Vessels in the 80,000 to 119,999 DWT range transported 95 percent of Texas City 2001-03 crude petroleum imports with the highest concentration of new tanker construction in the 100,000 to 119,999 DWT and 151,000 to 171,000 DWT ranges (Lloyd's Register CD-ROM, July 2005). The design drafts for 99 percent of 80,000 to 119,999 DWT vessels using Texas City exceed 40 feet (Table 16).

Table 16
Texas City Crude Petroleum Imports, 2000-2003
Median Vessel DWT and Design Draft

DWT Range	Vessel DWT	Design Draft (ft)	Year Built	% of Cargo Tonnage
Less than 47,999	19,225	33	1992	0.2%
47,999 to 59,999	54,857	41	1981	0.7%
60,000 to 69999	62,401	42	1983	3.8%
70,000 to 79,999	72,076	44	1997	0.6%
80,000 to 89,999	86,539	41	1986	22.6%
90,000 to 99,999	96,490	44	1992	34.8%
100,000 to 119,999	107,147	49	1998	32.8%
126,000 to 138,999	135,942	55	1993	0.1%
139,000 to 151,000	147,211	54	1993	2.5%
151,000 to 171,000	159,288	56	1997	2.0%
				100.0%

Source: Compiled from U. S. Army Corps of Engineers, Navigation Data Center detailed records, 2000-03.

Specific vessel design drafts and trade route limitations were of particular interest in identifying expectations concerning the percentage of tonnage anticipated to load to depths over 40 feet. Analyses revealed that nearly 75 percent of crude oil Texas City tonnage is shipped in vessels with loaded drafts greater than 36 feet. The current distribution of Texas City imports by vessel size and trade route is displayed in Table 17. Texas City's fleet records showed that the primary vessel size for the Mexico, Venezuela, and Eastern South America routes is 100,000 to 119,999 DWT, and examination of the per ton transportation cost for shipments from Mexico and South America to Texas City revealed that 100,000 to 119,000 DWT is a cost effective choice given channel depths between 40 and 48 feet. At the present time, tankers in the 60,000 to 69,999 DWT range

Table 17
Texas City Crude Petroleum Imports, 2001-03 By Trade Route and Vessel DWT

Trade Route or Region of Origin	47.9 to 59.9	60 to 69.9	70 to 79.9	80 to 89.9	90 To 99.9	100 to 119.9 a/	139.9 to 150 a/	>150	Total	Average 2001-03 Tonnage 1000's
	Vessel DWT Range (1000's)									
Canada	0%	0%	0%	0%	22%	48%	0%	30%	100%	349
Mexico	0%	0%	0%	29%	32%	39%	0%	0%	100%	3,396
Venezuela	1%	0%	0%	4%	15%	81%	0%	0%	100%	6,587
Guatemala	13%	78%	2%	0%	6%	0%	0%	0%	100%	1,327
Central & S America	1%	17%	5%	7%	24%	41%	4%	0%	100%	3,725
Western S America	0%	100%	0%	0%	0%	0%	0%	0%	100%	57
Western Africa	0%	0%	0%	0%	13%	43%	44%	0%	100%	1,156
Mediterranean & Europe	0%	0%	0%	8%	6%	23%	24%	38%	100%	1,750
Far East	0%	0%	0%	0%	0%	100%	0%	0%	100%	159
Mid East	0%	0%	0%	8%	29%	46%	9%	7%	100%	3,772
Gulf of Mexico Lightering b/	0%	0%	0%	23%	39%	34%	1%	2%	100%	16,495
Total	1%	5%	1%	15%	28%	43%	4%	4%	100%	38,733

a/ The 120-138K range represents less than 3 percent of the world fleet and do not generally use Texas City.
b/ Includes shuttle vessels and lightened mother vessels. The origins of the tonnage included in this group are primarily Middle Eastern shuttle vessels; this category includes tonnage Africa, Mediterranean, and Europe lightened mother vessels as well as shuttles.
Source: Compiled from U. S. Army Corps of Engineers, Navigation Data Center detailed records.

are generally used for crude shipped from Guatemala. While selection of these smaller tankers is due to channel depth restrictions and vessel availability, the design drafts of most of these vessels fall between 41 and 44 feet. Relatively small tankers are also used for movements from Ecuador. The Ecuadorian movements are, of course, restricted by the Panama Canal which presently limits loaded drafts to 39.6 feet and beam widths to 106 feet[10]. Shipments from Ecuador and Guatemala represent less than 1 percent of Texas City's 2001-03 import average. While the volume of tonnage shipped from Canada is low, all of the tankers used for Canadian crude shipments were in excess of 90,000 DWT. All 2001-03 tonnages came from Eastern Canada and were, therefore, not impacted by Panama Canal restrictions. The maximum size vessels used for Nigerian crude oil are principally in the 100,000 to 1650,000 DWT range. Vessels over 200,000 DWT are used for some Northern Europe transits associated with offshore lightering operations, in particular the North Sea and Norway movements. Vessels in the 200,000 to 375,000 DWT range are used for Persian Gulf crude; with most tonnage using 300,000 to 350,000 DWT vessels. The Corps' Navigation Data Center (NDC) records only includes records of vessels that come into U. S ports, such as Texas City, and does not include records of vessels

[10] Expansion of the Panama Canal which is likely within the next 15 years is anticipated to reduce beam width and draft restrictions.

that offload at the lightering zone. Most crude imported from the Persian Gulf is shipped in large crude carriers that offload their entire contents on to shuttle vessels. Table 18 presents Gulf of Mexico percentage of crude petroleum imports by trade route aggregated from the U. S. Department of Energy files.

Table 18
Petroleum Administration for Defense District III
(U. S. Gulf Coast Region)
Crude Petroleum Imports 2001-04

Trade Route	2001	2002	2003	2004	Average
Canada	0.0%	1.2%	0.5%	0.3%	0.5%
Mexico	24.1%	27.2%	27.1%	26.7%	26.3%
Venezuela	20.2%	20.5%	19.7%	20.5%	20.2%
Guatemala	0.3%	0.0%	0.4%	0.3%	0.3%
Central & South America	4.9%	4.8%	3.5%	2.9%	4.0%
Western South America	0.2%	0.1%	0.5%	1.2%	0.5%
Western Africa	10.5%	7.7%	9.6%	12.9%	10.2%
Mediterranean & Europe	4.4%	9.0%	9.0%	7.3%	7.4%
Far East	0.2%	0.2%	0.2%	0.1%	0.2%
Mid East	35.0%	29.3%	29.4%	27.8%	30.4%
Total PAD III Imports	100.0%	100.0%	100.0%	100.0%	100.0%

Source: Compiled from U. S. Department of Energy, Energy Information Administration website.

The format of the Corps of Engineers' Waterborne Commerce Statistics Center (WCSC) shipping records, obtained by the UASCE Navigation Data Center through the Bureau of Census, do not provide sufficient information to distinguish lightened tonnage from direct or lightered tonnage and, therefore, the EIA's Gulf Coast distribution was utilized to better identify relative percentages of imports by trade route. Consultation with Texas City industry representatives revealed that the Gulf Mexico destination well represents Texas City's recent historical distribution; therefore, the EIA Gulf Coast country of origin distribution was applied to the Texas City's 2001-03 base tonnage used for the 2010-60 tonnage projections. The NDC data is problematic in accurately identifying specific country of origin for lightered movements. The NDC data becomes useful in identifying the total volume of tonnage transferred offshore; however, it again becomes problematic in discerning direct shipments from vessels lightened offshore. Texas City's NDC data (Table 17) shows that 43 percent or an average of 16,495 thousand tons of 2000-03 import tonnage was transported through the Gulf of Mexico lightering zone. It is likely that this total primarily comprises shuttle vessels associated with Mid East imports; however, it also includes lightening mother vessels from various regions, principally Nigeria and other African locations.

Crude Petroleum Trade Routes and Methods of Shipment

Evaluation of the percentage of tonnage transported in vessels anticipated to utilize depths over 40 feet was primarily based on the relative change in per ton transportation cost between the existing 40-foot channel depth and increased channel depths. Cost analysis suggested that nearly all crude petroleum from Mexico, Venezuela, and Trinidad would utilize 45 feet. Expectations concerning the percentage of Middle East and Africa movements are subject to greater uncertainty. Nearly all Middle East tonnage is lightered. Lightering is also the least cost alternative for Far East tonnage. Lightering is defined as the process involving ship-to-ship transfer of oil cargo, and it is extremely cost effective for long-haul bulk freight and involves the transfer of tonnage at an offshore location from a larger vessel, called a VLCC (Very Large Crude Carrier), onto one or more shuttle vessels. Gulf Coast lightering occurs in the international waters of Gulf o Mexico. With lightering, the VLCC does not enter the coastal receiving port. The methods of shipping crude oil used for Texas City and other Texas Gulf Coast ports are primarily direct shipment or lightering and lightening. Lightening is a common alternative to either direct shipment or lightering for some routings, and it describes the process where enough cargo is offloaded from a tanker to permit the light-loaded mother vessel to enter a confined channel system. Africa, Mediterranean and Europe movements are either lightened or shipped direct. The tanker sizes associated with lightening on the Texas Coast generally range from 120,000 to 175,000 DWT. Tankers larger than 175,000 DWT are normally totally lightered offshore on to shuttles. Shipments from Africa, Mediterranean and Europe are usually transported in tankers between 80,000 and 175,000 DWT, with direct shipments generally using tankers between 80,000 and 120,000 DWT.

The logistics associated with offshore transfers introduces higher degrees of uncertainty than direct shipment and, therefore, generates large cost variances. Industry indicated that lower cost differences between direct versus offshore transfer costs may increase the likelihood of direct shipment. Industry personnel indicated that the number of days to completely lighter a VLCC normally ranges from 4 to 10 and that the average number of days to completely lighter 200,000 to 300,000 DWT vessels is 5.5; however, it was noted that 2 weeks is not uncommon. Five and one-half days equate to 1.5 times the in-port unloading rate. Utilization of the upper limit of 2 weeks appears to relate to a less than optimal number of shuttles and shuttle turnaround rate.

Comparison of direct shipment costs with those for lightering or lightening for the Africa Mediterranean and Europe route revealed that while the average cost for lightering or lightening is less than the average cost for shipping direct, the percentage difference between direct shipment costs and the offshore alternatives is considerably less than for either Mexico/South America or Mid East and Far East origins. The relative closeness in the costs between shipping methods for Africa, Mediterranean and Europe tonnage and, in particular, the variance associated with the number of days necessary to complete the offshore transfer process contributes to a higher percentage of direct shipment for this route than optimal or than least cost computations would suggest. A risk of delays, in association with the closeness in costs between shipping methods, contributes to a proportion of direct shipments that is higher than what might occur if the variance associated with the cost of lightering did not overlap with the cost of shipping direct. Examination of the cost data suggests that an increase in channel dimensions would probably result in an increase in direct shipment movements for Africa, Mediterranean and Europe shipments.

Comparison of the method of shipment costs for the Eastern South America and Persian Gulf did not indicate that the proposed project design would provide an incentive to switch from one method of shipment to another given channel depth constraints between 43 and 48 feet. In general, lightening is not cost effective for tonnage on the Persian Gulf trade route because the economies of scale associated with existing practices result in a lower cost for lightering than what would be attained through lightening. The reason lightering is cheaper than lightening for Persian Gulf/Indian Subcontinent shipments is because the magnitude of the mileage component of the per ton cost is large enough to offset the relatively large fixed cost attributable to having the mother vessel remain offshore for 5.5 days. For similar reasons, the relative short distance and high fixed costs associated with either lightening or lightering, eliminates any incentive for Mexico/Eastern South America shipments to shift to lightening. Despite the clear lack of economic rationale for lightering Mexico/Eastern South America tonnage or shipping Persian Gulf/Indian Subcontinent tonnage direct, relatively inefficient shipping methods are used for some shipments on these trade routes. The decision to lighter Mexico/Eastern South America tonnage or ship Persian Gulf/Indian Subcontinent tonnage direct results from less than perfect world market conditions. For purposes of analysis, the least cost practical alternative was assumed given existing technology and anticipated future innovations. Specifically, the cost calculations were made using direct shipment for the Americas; lightering for the Mid East and Far East; and lightening for Africa, Europe and Mediterranean for the 40-foot channel with a transition to direct shipment for increased channel depth alternatives based on transportation cost efficiencies.

Regardless of trade route, the vessel sizes utilized are also related to the way crude petroleum is sold. Currently, crude petroleum is sold in parcels of 500,000 barrels. A 500,000-barrel parcel converts to approximately 75,000 short tons. The most economical size vessel for a 75,000-ton parcel is between 75,000 and 100,000 DWT. For 150,000-ton parcels, the most efficient size is between 150,000 and 175,000 DWT. Ninety-four percent of the 100,000 to 140,000 DWT vessels in the world fleet have design drafts in excess of 45 feet, and 32 percent of the vessels between 75,000 and 100,000 DWT have design drafts over 45 feet. The with-project condition was formulated assuming that the maximum ship size for both direct shipments and lightered vessels would be 175,000 DWT. Vessels over 100,000 DWT would continue to be light-loaded under the with project condition; however, there would be a reduction in the number of feet light-loaded. Gulf Coast industry personnel indicated that parcel size and associated ship size are primarily a function of the existing channel dimensions and that an increase in channel dimensions would likely result in a shift to larger parcel sizes and larger vessels.

Crude Petroleum Trade Route Forecast

The trade route forecast for Texas City's crude petroleum imports was prepared based on analysis of the EIA trade route forecast and recent historical Texas City and U. S. Gulf Coast routings. The U. S. and Gulf Coast 2001-03 base distribution and the EIA 2003-25 trade route forecast are presented in Table 19. Table 20 summaries the results of application of the EIA 2001/03-30 U. S. growth rates to the Gulf Coast. The trade route forecast presented in Table 20 was then applied to the crude petroleum tonnage projections shown in Table 13. The port depths at major ports of origin are presented in Table 21.

Table 19
U. S. Total and U. S. Gulf Coast
Trade Route Forecast Distributions
Crude Petroleum Imports

Trade Route	U. S. Gulf Coast 2001-03 Average	U. S. Total 2001-03	U. S. Total 2010	U. S. Total 2020	U. S. Total 2025
	Historical Base		**Energy Information Administration Forecast**		
Mexico	25.6%	15.6%	14.3%	13.8%	13.3%
Venezuela & Guatemala	21.0%	13.4%	14.4%	13.9%	13.2%
Central & South America	4.4%	5.7%	5.3%	5.8%	6.8%
Western South America	0.6%	0.3%	4.1%	3.6%	3.1%
Mediterranean & Europe	7.5%	7.1%	1.1%	1.2%	1.3%
Western Africa	9.3%	13.6%	26.4%	25.8%	23.5%
Mid East	31.2%	26.1%	15.3%	15.0%	15.2%
Far East	0.2%	2.8%	3.3%	3.6%	3.8%
Canada	0.6%	15.4%	16.0%	17.3%	19.9%
Total	100.0%	100.0%	100%	100.0%	100.0%

Table 20
Trade Route Forecast Application Used for Texas City a/
Crude Petroleum Imports

Trade Route	U. S. Gulf Coast 2001-03	U. S. Gulf Coast 2010	U. S. Gulf Coast 2020	U. S. Gulf Coast 2025
Mexico	25.6%	20.8%	20.0%	19.3%
Venezuela & Guatemala	21.0%	20.8%	20.1%	19.2%
Central & South America	4.1%	3.4%	3.7%	4.4%
Western South America	0.6%	0.3%	0.3%	0.3%
Mediterranean & Europe	7.5%	13.8%	15.7%	16.9%
Western Africa	9.3%	8.4%	8.2%	7.5%
Mid East	31.2%	31.7%	31.1%	31.5%
Far East	0.2%	0.2%	0.2%	0.2%
Canada	0.6%	0.6%	0.6%	0.7%
Total	100.0%	100.0%	100.0%	100.0%

Source: U. S. Department of Energy, Energy Information Administration, Tables 24 (Table 18) and Table 117 (Table 19), January 2006.
a/ The EIA 2001/03 to 2010, 2020 and 2025 relative percentage changes were applied to the 2001/03 Gulf Coast distribution to estimate the expected 2010-2025 Gulf Coast and Texas City distributions.

Table 21
Port Depths at Major Ports Transporting Crude Oil and Petroleum Products

Region and Port	Country	Depth (ft) Port or Region
North and South America		
High Seas, Gulf of Mexico	International Waters	76
Freeport, Grand Bahamas	Bahamas	76
All Other Brazil Ports North Of Recife	Brazil	75 at Itaqui.
All Other Colombia, Caribbean	Colombia	>45 at several Eastern Ports
Georgetown	Guyana	33
Veracruz	Mexico	30.8
Altamira	Mexico	42
Coatzacoalcos a/	Mexico	42
Pajaritos a/	Mexico	42
Tuxpan	Mexico	42
Cayo Arcas a/	Mexico	72.2
Dos Bocas a/	Mexico	89.9
Orangestad	Netherland Antilles	76
San Nicolas Bay	Netherland Antilles	76
Point A Pierre	Trinidad	52
Rio Haina	Trinidad	58

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Table 21
Port Depths at Major Ports Transporting Crude Oil and Petroleum Products

Region and Port	Country	Depth (ft) Port or Region
North and South America		
La Guaira	Venezuela	19.7
Puerto Miranda	Venezuela	39.5
Amuay Bay	Venezuela	41 to 45
Puerto La Cruz	Venezuela	46 to 50
All Other Venezuela Ports	Venezuela	55 at Puerto La Cruz
Vancouver	Canada	Panama Canal Restriction
All Other Chile Ports	Chile	Panama Canal Restriction
La Libertad	Ecuador	Panama Canal Restriction
Middle East		
Ras Tanura	Saudi Arabia	61-65
All Other Saudi Arabia Ports	Saudi Arabia	61-65 at Ras Tanura
Far East		
Dalian	China	57.4, Panama Canal Restriction
All Other Republic Of China Ports	China	Panama Canal Restriction
Pulau Sambu	Indonesia	41-45
All Other Malaysia Ports	Malaysia	Panama Canal Restriction
All Other Singapore Ports	Malaysia	Panama Canal Restriction
Singapore	Singapore	66-70
Europe, Africa, and Mediterranean		
Skikda	Algeria	45.9
Arzew	Algeria	76
All Other Algeria Ports	Algeria	76 at Arzew; 46 at Skikda
Alexandria	Egypt	35
Shellhaven	England	47.9
Tallinn	Estonia	54
Murmansk	Former USSA	37.4
Wilhelmshaven	Germany	66
Ashdod	Israel	42.6
Rotterdam	Netherlands	74.3
Bonny	Nigeria	74.8
Kwa Ibo Terminal	Nigeria	85.3
Lagos	Nigeria	21 to 25
Calabar	Nigeria	<40; planned improvements at Calabar
Sture	Norway	75.4
Leixoes	Portugal	44.6
Lome	Togo	45.9
Istanbul	Turkey	39.4
All Other Turkey Mediterranean Region Ports	Turkey	Generally less than 40

Source: National Imagery and Mapping Agency, 2000 World Port Index, Pub. 150; Lloyds, World Shipping Encyclopaedia, April 2003; and USACE, Waterborne Commerce 1996-98 detailed records.
a/ Located in the same region as the offshore Cayo Arcas, Mexico's offshore oil terminal. Cayo Arcas can load vessel drafts of up to 76 feet.

Petroleum Product Fleet for Foreign Imports and Exports

Examination of Texas City's 2000-03 petroleum product import tonnage showed that 56 percent of product imports were transported in vessels with loaded drafts greater than 36 feet, and 71 percent were transported in product carriers with design drafts over 40 feet. The import groups anticipated to take advantage of depths over 40 feet are limited to fuel oil, gas oil, light oils. Review of exports showed 28 percent of product exports were transported in vessels with loaded drafts greater than 36 feet, and 41 percent of exports were transported in vessels with design drafts in excess of 40 feet. Large product carriers are used for the exports of fuel oil, gasoline, and petroleum coke; however, petroleum coke is shipped from a portion of the channel which will not be deepened as part of recommendations stemming from the LRR and, therefore, were excluded from the deepening analysis. Table 22 summarizes the Texas City's 2000-03 distribution of petroleum product imports and exports by vessel DWT range for commodity groups anticipated to benefit from the proposed channel improvements.

Table 22
Texas City Petroleum Product, 2000-2003
Percentage of Imports and Exports by Vessel DWT

DWT Range	Design Draft (ft)	2000	2001	2002	2003	Average
Texas City Petroleum Product Imports						
Less than 47,999	37	23.3%	20.9%	19.2%	24.2%	21.9%
47,999 to 59,999	42	21.1%	6.5%	4.0%	0.0%	7.9%
60,000 to 69999	44	42.8%	43.7%	33.1%	43.9%	40.9%
70,000 to 79,999	46	0.8%	4.9%	5.4%	24.8%	9.0%
80,000 to 89,999	42	1.4%	5.1%	7.0%	4.8%	4.6%
90,000 to 99,999	47	3.9%	6.5%	11.1%	0.0%	5.4%
100,000 to 119,999	49	6.7%	12.5%	20.3%	2.2%	10.4%
120,000 to 138,999	n/a	0.0%	0.0%	0.0%	0.0%	0.0%
Total		100.0%	100.1%	100.1%	100.0%	100.0%
Texas City Petroleum Product Exports a/						
Less than 47,999	38	41.1%	42.3%	80.3%	81.1%	61.2%
47,999 to 59,999	43	28.3%	8.3%	0.0%	0.0%	9.2%
60,000 to 69999	43	20.6%	15.3%	7.7%	10.1%	13.4%
70,000 to 79,999	n/a	0.0%	0.0%	0.0%	0.0%	0.0%
80,000 to 89,999	48	6.0%	8.6%	0.0%	0.0%	3.7%
90,000 to 99,999	45	4.0%	7.6%	12.0%	8.7%	8.1%
100,000 to 119,999	47	0.0%	17.9%	0.0%	0.0%	4.5%
120,000 to 138,999	n/a	0.0%	0.0%	0.0%	0.0%	0.0%
Total		100.0%	100.0%	100.0%	100.0%	100.0%

Source: Compiled from U. S. Army Corps of Engineers, Navigation Data Center detailed records.
a/ Excludes Petroleum Coke.

Petroleum Product Foreign Import and Export Tonnage Forecast Methodology

Texas City's petroleum product projections were prepared based on analysis of historical trends and EIA and Global Insight's forecast indicators. The EIA forecast was used for the base. Data pertaining to U. S. and Texas City relative rates of growth are displayed in Table 23 and Figures 4 and 5. Texas City exports exhibited higher overall growth in comparison to U. S exports which essentially remained flat, particularly in recent years. In comparison, U. S. product imports exhibited consistent upward growth since the 1990s. In both the case of imports and exports, Texas City tonnage experienced high long-term growth relative to the U. S. totals.

Table 23
Texas City and U. S. Petroleum Products (1000's of short tons)
Foreign Imports and Exports

	Texas City Petroleum Products		U. S. Total Petroleum Products	
Year	Imports	Exports a/	Imports	Exports a/ b/
1985	406	210	74,154	21,535
1986	99	69	91,669	22,571
1987	184	206	90,113	23,427
1988	107	159	107,294	23,240
1989	64	407	109,038	26,689
1990	480	732	109,470	30,785
1991	326	1,211	96,085	39,027
1992	448	569	92,054	37,973
1993	291	758	99,236	37,282
1994	445	274	100,861	33,305
1995	962	236	78,166	33,742
1996	500	343	98,316	33,412
1997	639	826	104,167	33,206
1998	237	513	118,666	30,442
1999	791	692	124,049	30,126
2000	1,519	842	130,032	32,125
2001	1,382	1,058	134,307	33,089
2002	2,326	720	129,970	32,201
2003	1,254	910	145,792	30,047
		Compound Annual Rates of Growth		
1985-99	4.9%	8.9%	3.7%	2.4%
1999-03	12.2%	7.1%	4.1%	-0.1%

Source: U. S. Army Corps of Engineers, Waterborne Commerce of the U. S., Part 2, 1990-2003.
a/ Excludes petroleum coke.
b/ The EIA total for 2003 shows a 6 percent increase over 2002 whereas the NDC data shows a 7 percent decrease; however, the overall historic long-terms rates are comparable.

FIGURE 4
Texas City Petroleum Product Imports and Exports 1985-03
1000's of short tons

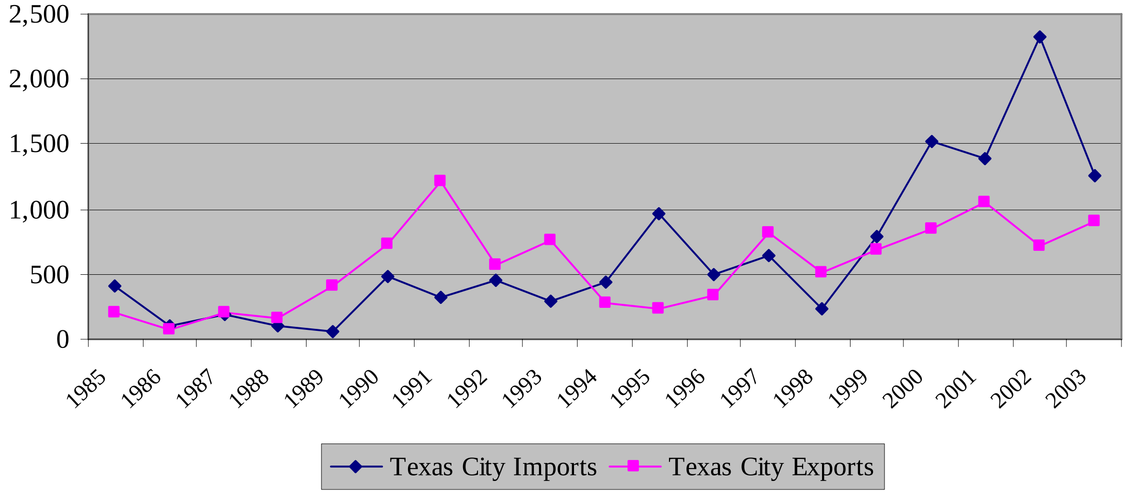
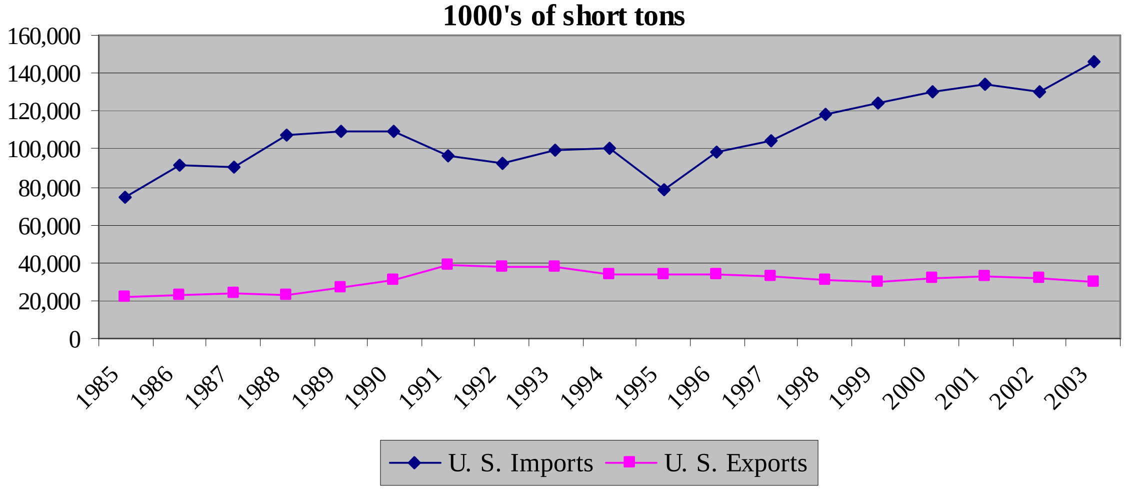


FIGURE 5
U. S. Petroleum Product Imports and Exports 1985-03
1000's of short tons



Note: Exports exclude petroleum coke.

Table 24 presents the national forecasters' crude petroleum and product export forecasts. Comparison of the forecasts helps illustrate the relative differences in growth for EIA and GI's crude petroleum imports versus product imports and the anticipated substitution between the two import groups. The regional dynamics associated with the interrelationship and trade-off effects between crude and product imports indicates that the EIA forecast may be more reflective of long-term expectations for Texas City than the Global Insight forecast. Moreover, Texas City refinery gains and increased downstream capacity suggest that the EIA distribution more accurately reflects regional expectations of continued high refinery inputs for Texas City processing or throughput to Houston. As previously noted, approximately 15 percent of Texas City's crude import imports are presently pipelined to Houston and additional existing throughput capacity exists.

Table 24
U. S. Petroleum Trade Baseline Forecasts
Comparison Energy Information Administration (EIA) and Global Insight

	EIA Forecast (1000's of barrels per day)					Average Annual Growth Rates (%)	
Commodity	2003	2004	2010	2020	2030	2003-10	2003-30
Crude Petroleum Imports	9,660	10,090	10,085	11,280	13,530	0.6%	1.3%
Refined Products Imports	1,850	2,070	2,390	3,130	3,560	3.7%	2.5%
Unfinished Oils	340	490	410	540	660	2.7%	2.5%
Blending Components	410	410	460	520	570	1.7%	1.2%
Total Product Imports	2,600	2,970	3,260	4,190	4,790	3.3%	2.3%
Product Exports a/	956	976	980	1,030	1,070	0.4%	0.4%
	Global Insights Forecast (1000's of barrels per day)						
Commodity	2003	2004	2010	2020	2030	Growth Rates (%)	
Crude Petroleum Imports	9,660	10,090	10,790	11,953	13,115	1.6%	1.1%
Refined Products Imports	1,850	2,070	3,067	5,155	7,109	7.5%	5.1%

Global Insight does not publish an export forecast for refined products

a/ Excludes crude petroleum and natural gas.

Source: U. S. Department of Energy, Energy Information Administration, Table 117; Global Insight, Sept 2005.

The EIA U. S. product export forecast displayed in Table 24 indicates low national export growth for 2003-10 with the average annual growth rate of 0.6 percent for U. S. product exports considerably lower than either Texas City's long-term and short-term growth rates of over 15 percent (Table 23). The EIA trade route forecast specific for light and heavy product imports are displayed in Tables 25-26.[11] U. S. imports of light products, which include gasoline, gasoline blending components, and distillate fuel oil, are forecasted to increase at an annual average rate of approximately 2.9 percent for 2001/03-30. Average annual growth rates for imports of heavy petroleum products are 1.3 percent for 2001/03-30. Heavy products include residual fuel oil and unfinished oils including lube oil. Historically, Texas City's share of heavy products exceeded that for light products but in recent years the distribution is similar to the U. S. distribution.

Combined product growth for 2001/03-30 U. S. imports is 2.3 percent. As indicated the 2001/03-30 rate of 2.3 percent is lower than either the U. S. historical base rate of 4.0 percent (Table 22) or Global Insight's rate of 5.1 percent. Global Insight's 2001-30 expected rates of growth suggest general continuation of historical trends whereas the EIA forecast indicates a downturn in product import growth from the 1999-03 rate of 4.3 percent. The expectation for Texas City is that product imports will continue to increase with long-term growth reflecting the EIA forecast trends.

Table 25
U. S. Light Petroleum Product Imports by Trade Route Region a/

	Total Barrels Imports (1000's Barrels Per Day)				AAG 2001/03	Percentage by Trade Route			
Trade Route	2001-03	2010	2020	2030	to 2030	2001-03	2010	2020	2030
Northern Europe	177.7	340.0	430.0	450.0	3.4%	12%	16%	14%	14%
S Europe & Mediterranean	126.0	170.0	300.0	320.0	3.4%	9%	8%	10%	10%
West Africa	9.3	70.0	110.0	120.0	9.5%	1%	3%	4%	4%
Latin America	122.3	180.0	310.0	340.0	3.7%	8%	9%	10%	10%
Far East	128.0	180.0	270.0	290.0	3.0%	9%	9%	9%	9%
Persian Gulf	35.3	80.0	210.0	250.0	7.2%	2%	4%	7%	8%
Caribbean	265.0	380.0	530.0	540.0	2.6%	18%	18%	17%	17%
Other	180.0	210.0	300.0	310.0	2.0%	12%	10%	10%	10%
Canada	423.7	490.0	610.0	640.0	1.5%	29%	23%	20%	20%
Light Product Total	1467.3	2100.0	3070.0	3260.0	2.9%	100%	100%	100%	100%

a/ Includes residual fuel oil, unfinished oils, and other refined products.
Source: U. S. Department of Energy, Energy Information Administration, Table 117.

[11] Trade route details are not presented in the Global Insight data. Neither EIA and Global Insight produce trade route details for product exports.

Table 26
U. S. Heavy Petroleum Product Imports by Trade Route Region a/

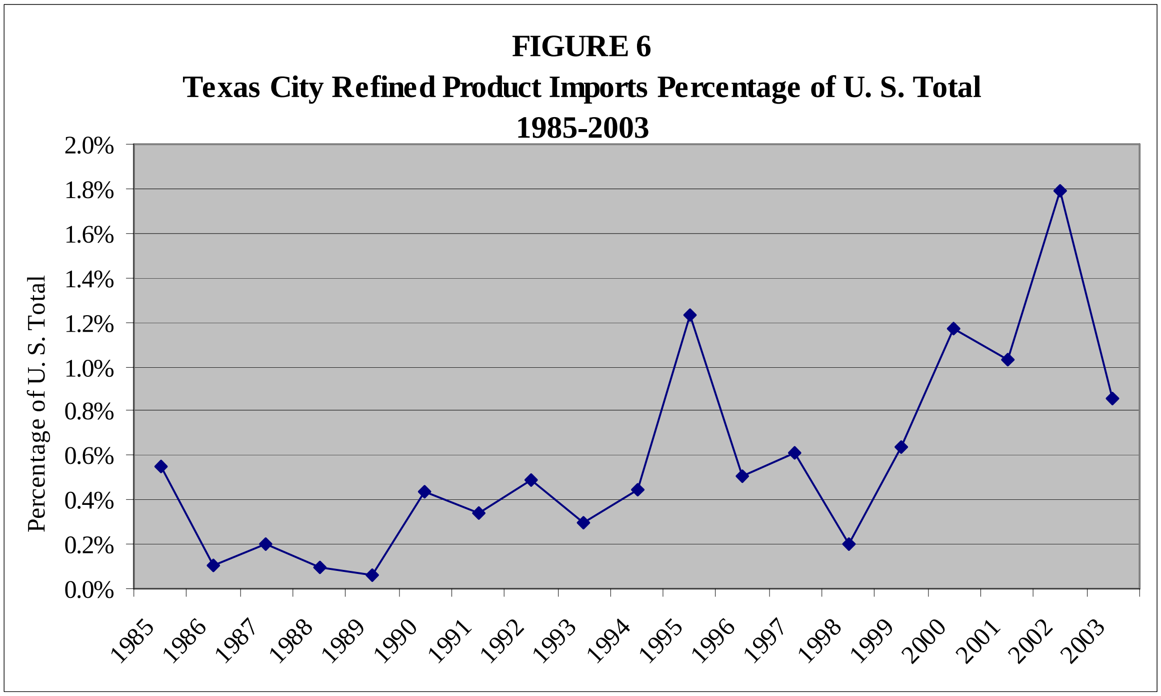
Trade Route	Total Barrels Imports (1000's Barrels Per Day) 2001-03	2010	2020	2030	AAG 2001/03 to 2030	Percentage by Trade Route 2001-03	2010	2020	2030
Northern Europe	162.0	160.0	140.0	200.0	0.8%	15%	14%	13%	13%
S Europe & Mediterranean	245.3	250.0	240.0	300.0	0.7%	23%	21%	21%	20%
West Africa	24.7	30.0	40.0	40.0	1.7%	2%	3%	4%	3%
Latin America	100.3	90.0	90.0	160.0	1.7%	10%	8%	8%	11%
Far East	108.7	130.0	140.0	170.0	1.6%	10%	11%	13%	11%
Persian Gulf	43.3	50.0	60.0	130.0	4.0%	4%	4%	5%	9%
Caribbean	142.7	230.0	170.0	240.0	1.9%	14%	20%	15%	16%
Other	140.7	160.0	160.0	170.0	0.7%	13%	14%	14%	11%
Canada	81.7	70.0	80.0	100.0	0.7%	8%	6%	7%	7%
Heavy Product Total	1049.3	1170.0	1120.0	1510.0	1.3%	100%	100%	100%	100%

a/ Includes residual fuel oil, unfinished oils, and other refined products.
Source: U. S. Department of Energy, Energy Information Administration, Table 117.

Petroleum Product Import Forecast Application to Texas City

Forecast expectations for Texas City's product imports were based on consideration of the EIA and Global Insight forecasts and Texas City's historical trendline. Figure 6 displays Texas City's 1985-03 percentage share of U. S. total petroleum product imports. The data revealed that, while annual variances are high, Texas City's overall share of the U. S. products increased. A noted affect of relatively high regional growth in comparison to low national growth is poor statistical correlation with U.S. product movements, and as a result, regression analysis applications are not particularly meaningful.

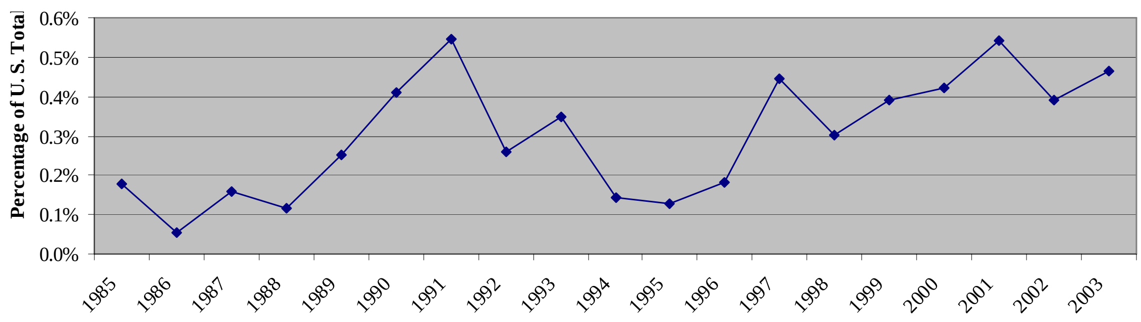
Review of other indicators, such as regional employment for various industrial sectors, exhibited higher degrees of applicability but overall correlation was again found to be weak. Absence of good statistical correlation between Texas City and national indicators, in combination with Texas City's relative high growth rates does suggest that, at a minimum, the national growth rates may be applicable, albeit conservative. For purposes of the LRR, Texas City's product import forecasts are based on direct application of the AEO2006 growth rates using Texas City's 2001-03 average product volumes as a base.



Petroleum Product Export Tonnage Forecast

Forecast expectations for Texas City's future exports was made based on consideration of the EIA forecast and Texas City's historical trendline. Examination of Texas City's historical share of U. S. product exports revealed that Texas City has experienced upward growth. Figure 7 displays Texas City's 1985-03 percentage share of U. S. total petroleum product exports. The display indicates that while annual variances are high, Texas City's share has, on average, increased. As with imports, Texas City's 1985-03 product exports grew at much higher rates than national product totals. Again, as with imports, absence good statistical correlation between Texas City and national indicators, in combination with Texas City's relative high growth rates generally suggests that, at a minimum, the national growth rates may be applicable, albeit conservative. EIA is forecasting a 0.4 percent 2003-30 annual growth rate. For purposes of the LRR, Texas City's product export forecast was prepared by applying the EIA growth rates to Texas City's 2001-03 historical base.

FIGURE 7
Texas City Refined Product Exports Percentage of U. S. Total
(Excludes Petroleum Coke)



Texas City Product Exports (Excluding Petroleum Coke)

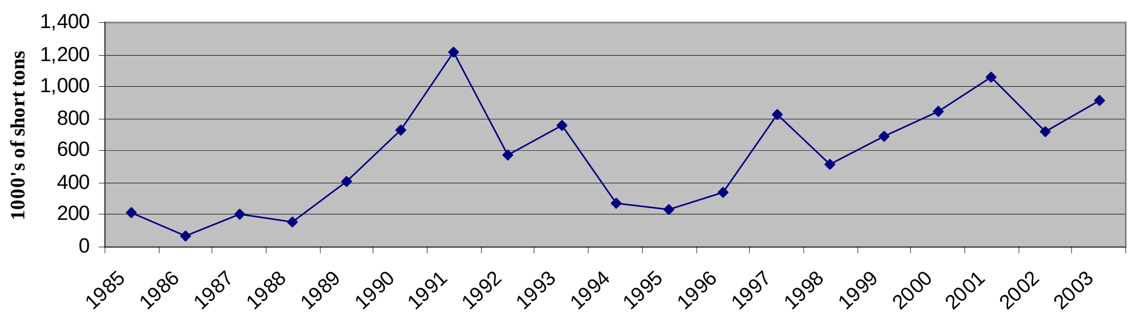


Table 27 summarizes EIA and Global Insight's forecast scenarios and their application to Texas City's import and export base. Again, the Global Insight forecast application is shown for comparative purposes.

Table 27
Petroleum Product Import and Export Forecast
Texas City Application (short tons in 1000's)

	Texas City Imports		Texas City Exports
Year	EIA Growth Rate Application	Global Insight Growth Rate Application	EIA Growth Rate Application
2001/03	1,654	1,654	895
2010	2,186	2,742	966
2020	2,842	4,608	1,015
2030	3,239	6,356	1,055
2040	3,691	7,021	1,096
2050	4,206	7,756	1,138
2060	4,794	8,567	1,183
Average Annual Growth Rates			
2001/03 to 2030	2.5%	5.1%	0.6%
2030-60	1.3%	1.0 %	0.4%

Percentage of Texas City Tonnage Used for Benefit Calculations
(Discussed in Following Section)

Imports	Exports
41%	15%

Source: U. S. Department of Energy, Energy Information Administration, December 2005, and Global Insight, Petroleum Supply/Demand Balance, Table 13, September 2005.

Foreign Trade Route Analysis for Product Movements

Determination of the percentage of product imports and exports likely to utilize vessels with loaded drafts over 40 feet was based on examination of the recent historical load patterns and channel depth constraints at trading ports. Table 28 displays data pertinent to Texas City's 2000-04 vessel loadings. The median design draft for Texas City parcels of 45,000 or more was approximately 45 feet for imports and 44 feet for exports.

For purposes of analysis, estimation of the future percentage of cargo anticipated to load to drafts over 40 feet was made based on historical volumes associated with parcels larger than 60,000 short tons and vessel design drafts over 40 feet, along with trade route limitations. The historical data exhibits variance and future expectations are for continued variance. In spite of uncertainties, Texas City's 2000-04 product carrier utilization record, with nearly 70 percent of imports and over 40 percent of exports moving in maximum-design draft vessels over 40 feet, and world vessel fleet trends showing increasing availability of tankers between 90,000 and 114,999 DWT suggests that some product carriers will likely utilize channel depths over 40 feet.

In comparison to crude petroleum, product tonnage volumes will recognizably continue to represent a relatively small portion of total tonnage. Products represented 15 percent of 2000-03 total ocean-going crude oil and product tonnage and are anticipated to maintain a relatively constant share.

Table 28
Texas City Channel
Petroleum Product Imports and Exports
Approximate Percentage of Tonnage Associated with Draft Constrained Vessels

% Product Import Tonnage Transported	2000	2001	2002	2003	2004	Avg.
in Vessels with Design Drafts >40 ft.	62%	73%	77%	61%	74%	69%
in Vessels with Loaded Drafts >36 ft.	56%	55%	57%	70%	67%	61%
in Vessels with Loaded Drafts >37 ft.	43%	33%	54%	58%	53%	48%
% Tonnage Associated with Larger Parcels						
parcels >=45000 short tons	62%	63%	65%	58%	44%	59%
parcels >=50000 short tons	59%	60%	55%	54%	40%	54%
parcels >=60000 short tons	28%	35%	43%	10%	25%	28%
Total Imports in 1000's of short tons	1,519	1,382	2,326	1,254	3,175	

% Product Export Tonnage Transported	2000	2001	2002	2003	2004	Avg.*
in Vessels with Design Drafts >40 ft.	38%	66%	23%	32%	56%	43%
in Vessels with Loaded Drafts >36 ft.	28%	n/a *	61%	34%	43%	42%
in Vessels with Loaded Drafts >37 ft.	11%	n/a *	45%	9%	39%	26%
% Tonnage Associated with Larger Parcels						
parcels >=45000 short tons	33%	45%	28%	24%	42%	34%
parcels >=50000 short tons	8%	45%	28%	14%	35%	26%
parcels >=60000 short tons	0%	33%	12%	8%	28%	16%
Total Exports in 1000's of short tons (excludes petroleum coke)	842	1058	720	910	1417	

* Loaded drafts for 94 percent of the 2001 petroleum products exports were not contained in the Waterborne Commerce database and are excluded from the average.
Source: U. S. Army Corps of Engineers, Waterborne Commerce of the U. S, detailed records, 2000-04.

Much of the annual variance in product volumes stems from the time sensitive needs for raw material, particularly distillate oil. The Texas City refineries have the capability to refine both heavy and light crude. When a heavy sour production source is disrupted, refiners can run a lighter mix of crude oils, but as in the recent Venezuelan production loss, the acquisition of additional crude oils and the shifting takes time, and runs will generally be reduced for a short time. While refineries such as Texas City, which use heavy Venezuelan crude, can use some lighter crude oils from areas like West Africa, they are designed to run most economically with the heavier crude oils. A large number of refineries in the United States can process light, sweet crude oils, while only the small fraction of refineries that have extensive desulfurization and bottoms-conversion units can use heavy, high sulfur crude oils such as that produced in Venezuela, Mexico, and Saudi Arabia, among other locations.

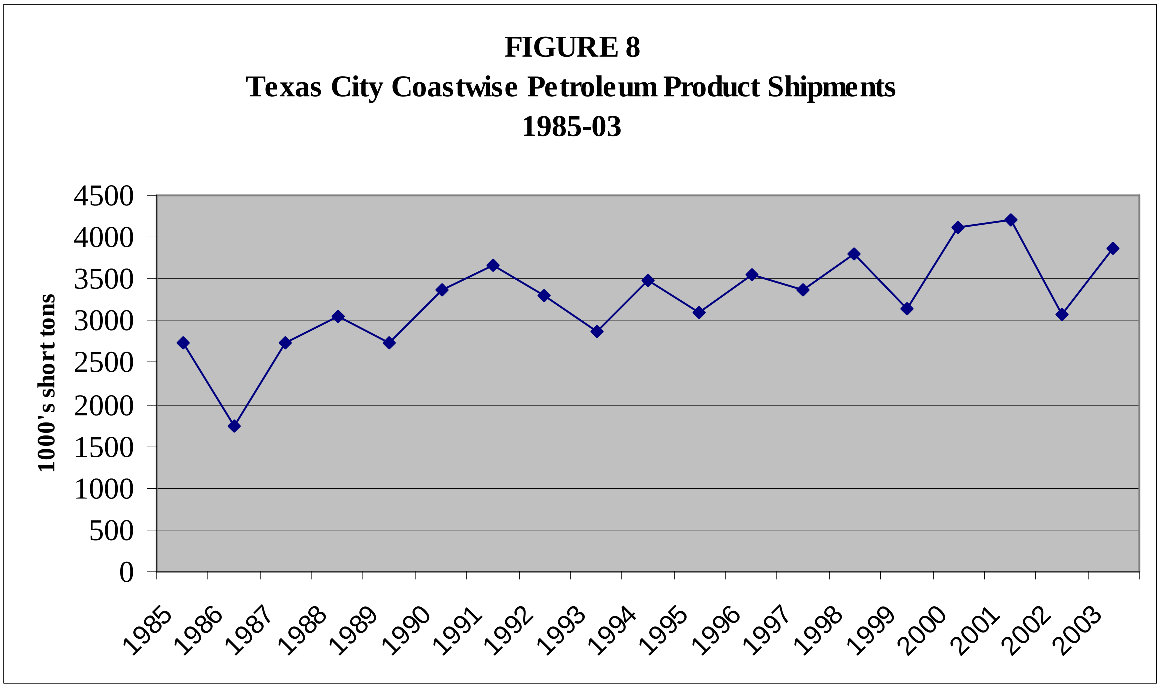
Analysis of EIA forecasts suggests modest long-term growth for Texas City distillate, with U. S. distillate imports increasing at a higher rate than Texas City. The future expectation that Texas City crude oil imports will be dominated by Venezuela and Mexico movements and other lower price heavy crude, when available, is indicative that Texas City's distillate imports will grow at a slower rate than for the nation, with distillate imports increasing to match shortfalls in heavy crude from Venezuela and Mexico.

For product exports, again distillate and gasoline are the primary commodities. Gasoline exports for the U. S. are anticipated to grow at an annual rate of less than 1 percent. Texas City gasoline exports are expected to grow at an annual rate of about 1 percent. The EIA notes that *s*ince the United States is the world's largest importer, it may seem surprising that it also exports around 1 million barrels a day of oil, predominantly petroleum products. Various logistical, regulatory, and quality considerations result in the export of some petroleum grades and products. For example, the Gulf Coast may export lower quality gasoline to Latin America while the East Coast imports higher quality gasolines from Europe.

Texas City's transportation benefits were evaluated for channel depth alternatives of 43 to 45 feet. The percentage of Texas City product imports used for the benefit calculations was 40 percent. The percentage of Texas City product exports used for the benefit calculations was 15 percent. These percentages were identified based on examination of parcel sizes and trade route restrictions. Analysis of foreign port depths and trade routes indicated that these percentages were reasonable.

Domestic Coastwise Petroleum Products

As previously noted, examination of Texas City's 2001-03 coastwise petroleum product vessels showed that approximately 10 percent of outbound coastwise shipments were transported in draft restricted tankers. The largest product carriers generally are between the 60,000 and 80,000 DWT with design drafts in the 41 to 43-foot range. Domestic coastwise movements primarily consist of gasoline, kerosene, and jet fuel. In 2003, coastwise shipments totaled nearly 4 million. Coastwise receipts were 292 thousand short tons. Coastwise product tonnage for 1990-03 is included in the "other ocean-going tonnage" column in Table 2. Tonnage growth is primarily associated with shipments. Figure 8 displays Texas City's 1985-2003 coastwise shipment trendline.



Detailed examination of Texas City's 2001-03 shipments showed that 35.9 percent of 2001-03 coastwise products were transported in vessels with loaded drafts over 36 feet (Table 29). Coastwise receipts are not limited by the existing channel depth. As noted, the design draft of 10 percent of the coastwise shipment tankers exceeds 40 feet. The vessels used are all U. S. flag vessels, Jones' Act vessels. The median age of the current fleet exceeds 10 years, with most vessels built in the 1980s. It is expected that the eventual replacement fleet will generate a higher concentration of slightly larger vessels. Additionally, it is expected that the design drafts for new vessel orders will in the 40- to 43-foot range. Review of "vessels on order records" for U.S. tankers showed several new orders for vessels in the 60,000 to 80,000 DWT range. The majority of the current draft-constrained tankers were outbound movements of gasoline from Texas City to Port Everglades, Florida. Port Everglades has a channel depth of 42 feet and more fully loaded vessels could be accommodated. In addition to Port Everglades, there are several other U. S. East Coast ports at depths between 42 and 45 feet, with New York Harbor presently authorized to 50 feet. General indicators associated with U. S. port depth trends and eventual vessel replacement expectations

Table 29
Texas City Coastwise Petroleum Product Shipments
Tonnage by Loaded Vessel Draft

Loaded Draft (ft)	2001	2002	2003	Average
<=30	1,335,299	858,798	577,757	923,951
31-36	1,386,724	1,549,885	1,603,396	1,513,335
>=37	1,868,113	683,207	1,781,642	1,444,321
Total	4,590,136	3,091,890	3,962,795	3,881,607
<=30	29.1%	27.8%	14.6%	23.8%
31-36	30.2%	50.1%	40.5%	40.3%
>=37	40.7%	22.1%	45.0%	35.9%
Total	100.0%	100.0%	100.0%	100.0%

Source: Compiled from U. S. Army Corps of Engineers, Navigation Data Center detailed records.

suggest that 10 percent of Texas City coastwise tonnage would utilize loaded depths of 42 feet by the year 2010 given channel depth availability in Texas City. It is not unreasonable to assume that the expected 10 percent estimate would increase to 20 percent by year 2020. For the purposes of this report, 10 percent of 2010 and 20 percent of 2020-60 coastwise tonnage were used for the channel deepening calculations. Due to continuing uncertainty about Jones Act restrictions, a sensitivity using foreign-flag vessels was also prepared. The purpose of the sensitivity was to better determine effects on plan optimization with a particular emphasis on the effects of a lower benefit base.

Reduction in Transportation Cost Benefits

Channel deepening benefits were calculated for Texas City's crude petroleum and petroleum products cargoes. The transportation savings benefits were calculated using a Federal discount rate of 5.125 percent and using Fiscal Year 2005 hourly operating costs (EGM 05-01). Per ton transportation costs for channel depth alternatives of 43, 44, 45, 48, and 50 feet were compared with the existing 40-foot channel depth costs.

As discussed, the percentage of crude petroleum and petroleum products tonnage expected to accrue benefits from deeper channel depths was identified based on an examination of vessel sizes, vessel loads, foreign port depths and constraints such as the Panama Canal. Port depth, trade route, and historical vessel utilization data were used to identify the percentage of tonnage anticipated to benefit from the Texas City proposed depth increases. Texas City will not accrue deepening benefits for movements associated with the Western South America trade route nor for direct shipments from the Far East due to the vessel beam width constraint of 106 feet and the depth constraint of 39.6 feet at the Panama Canal. Some crude oil shipped from the Far East is, however, shipped in post-Panamax vessels. These vessels arrive in the Gulf of Mexico by way of the Suez Canal or the Cape of Good Hope. Post-Panamax, Suez, and VLCC vessels used for Far East crude oil could realize cost savings from increased channel depths in Texas City and the benefit calculations reflect this inclusion; however, total Far East volumes to the U. S. Gulf Coast are presently small (Table 17) and expected to remain so.

The transportation costs and the savings associated with the proposed project depth increase were calculated using commodity specific vessel class and trade route distributions. Transportation costs were calculated based on the channel depth alternatives and variables associated with vessel design drafts, maximum feet of light-loading, underkeel clearance, mileage traveled, and the number of hours to load and unload. Maximum vessel cargo capacities for crude oil and petroleum products were estimated based on review of the range of load factors obtained from IWR Report 91-R-13, National Economic Development Procedures Manual Deep Draft Navigation, November 1991 and consultation with Texas City industry and pilots association. The IWR Report 91-R-13 cargo capacity factors published in the deep draft manual for dry bulk carriers and tankers are shown in Table 30. Consultation with industry and the pilots revealed that these estimates are reasonable.

Table 30
Adjustments for Estimating Actual Vessel Capacity
Short Tons of Cargo as a Percentage of Vessel DWT

Vessel DWT	% Cargo to DWT
<20,000	90%
20,000 to 70,000	92%
70,000 to 120,000	95%
>120,000	97%

Source: IWR Report 91-R-13, National Economic Development Procedures Manual, Deep-Drat Navigation, November 1991, p. 77.

Table 31 presents representative round trip mileage for the trade routes or junction points used for the transportation savings computations. Table 32 presents the Fiscal Year 2005 operating cost data obtained from EGM 05-01. Double-hull foreign flag tankers were used to calculate the transportation costs for foreign imports of crude petroleum and petroleum product imports and exports. Double-hull U. S. flag tanker costs were used for coastwise product shipments. The maximum size tankers presently used for U. S. coastwise movements are in the 60,000 to 70,000 DWT range.

Table 31
Representative Round Trip Mileage to Texas City

Coatzacoalcos, Mexico	1,376
U. S. Gulf Coast Lightering/Lightening Zone	160
Venezuela	3,612
Panama Canal	3,120
Brazil (Maceio/Sao Paulo weighted average)	9,422
Rotterdam, Netherlands	10,040
Sture, Norway	10,528
North Africa, Algiers	10,294
West Africa (Nigeria and Angola)	12,500
Persian Gulf and Indian Subcontinent via Suez Canal	19,704
Persian Gulf and Indian Subcontinent via Cape of Good Hope	25,112
Singapore via Panama Canal	24,248
Singapore via Cape of Good Hope	26,304

Table 32
Tanker Vessel Characteristics and Hourly Operating Cost
FY 2005 Double Hull Tankers
As Presented in EGM 05-01

	Design				Hourly Tanker Cost			
Vessel	Draft	Immersion	Length	Beam	Foreign-Flag		U. S. Flag	
DWT	(feet)	Factor	(feet)	(feet)	At Sea	In Port	At Sea	In Port
20,000	29.9	78.7	497.7	79.5	$617	$475	$1,413	$1,271
25,000	32.0	90.8	531.1	85.4	$639	$490	$1,457	$1,308
35,000	35.4	112.6	585.8	95.1	$682	$520	$1,545	$1,383
50,000	39.5	141.4	649.9	106.7	$752	$570	$1,681	$1,499
60,000	41.8	158.9	685.3	113.1	$795	$600	$1,768	$1,573
70,000	43.8	175.4	716.8	118.8	$838	$630	$1,855	$1,648
80,000	45.6	191.0	745.2	124.1	$880	$660	$1,942	$1,722
90,000	47.3	205.9	771.2	128.8	$919	$687	$2,008	$1,775
120,000	51.6	247.5	838.5	141.3	$1,019	$749	$2,198	$1,928
150,000	55.2	285.4	894.8	151.8	$1,127	$820	$2,400	$2,669
175,000	57.9	315.0	935.9	159.5	$1,225	$888	$2586	$2,248
200,000	60.3	343.0	973.0	166.5	$1,318	$951	$2,766	$2,399
265,000	65.7	410.7	1,056.0	182.3	$1,555	$1,111	$3,214	$2,770
325,000	69.9	467.9	1,120.7	194.6	$1,715	$1,201	n/a	n/a

Compiled from USACE, Economic Guidance Memorandum, 05-01, October 2004.

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The basic procedure used to calculate transportation costs using a 90,000-DWT foreign flag tanker as an example is illustrated in Table 33. Similar computations were made for appropriate distances and vessel sizes for each of the channel depth alternatives. The resulting costs per ton computations were calculated over the relevant range of vessels projected for each channel depth improvement, and the associated savings per ton were measured using the net differences in costs between the existing 40-foot channel and the depth alternative.

Table 33
Transportation Cost Calculation
Mexico to Texas City

Vessel Characteristics and Cost Inputs	
Vessel DWT	90,000
Design Draft (ft.):	47.3
Cargo Capacity: DWT * 95%	85,500
Immersion Factor (tons per inch) a/	205.9
Hourly Cost at Sea:	$919.0
Underkeel Clearance (ft) a/	3
Hourly Cost in Port:	$687.0
Loading/Unloading Rate (tons/hour)	5,250
Round Trip Mileage	1400
Speed (Knots):	15
Cost for Voyage: (mileage/speed)*(hourly vessel cost)	$85,773
Maximum Load on 40 Foot Channel b/	60,051
Hours to Load and Unload above short tons:	22.6
Voyage Cost/Ton for 40-ft. Channel	$1.43
Loading & Unloading Cost/Ton for 40-ft. Channel	$15,716
Cost/Ton for Loading and Unloading for 40-ft. Channel	$0.26
Total Cost Per Ton on 40-ft. Channel	$1.69
Maximum Load on 45 Foot Channel b/	72,405
Voyage Cost/Ton for 45-ft Channel	$1.18
Loading & Unloading Cost/Ton for 45-ft Channel:	$0.26
Total Cost Per Ton on 45 -ft. Channel	$1.45
Per Ton Savings Between 45- and 40-foot Channel	$.24

a/ Discussion of these variables are presented in the Economic Appendix.
b/ ((DWT * Maximum % Load)-(Immersion Factor * 12 * number feet light-loaded)

Application Considerations

Examination of Texas City's vessel fleet, in particular the DWT and design draft relationship, revealed differences between the vessel characteristics of the Texas City tanker fleet with the characteristics shown in the EGM. The design drafts for tankers in the 70,000 to 90,000 DWT using Texas City is lower than those shown in the EGM. In addition, there were differences in vessel length and beam between Texas City's fleet and the EGM data. The effect of using Texas City's lower draft vessels reduced the magnitude of the transportation savings benefits. Table 34 displays a composite of Texas City's 2000-03 crude petroleum tanker fleet. Comparison of the EGM vessel characteristics with those

Table 34
Texas City Crude Petroleum Imports, 2000-2003
Length (LOA), Beam and Design Draft (ft), Median Dimensions

DWT Range	Vessel DWT	Design Draft (ft)	LOA (ft.)	Beam (ft.)	Year Built	% of Cargo Tonnage
Less than 47,999	19,225	33	508	76	1992	0.2%
47,999 to 59,999	54,857	41	682	106	1981	0.7%
60,000 to 69999	62,401	42	743	106	1983	3.8%
70,000 to 79,999	72,076	44	745	113	1997	0.6%
80,000 to 89,999	86,539	41	800	133	1986	22.6%
90,000 to 99,999	96,490	44	807	138	1992	34.8%
100,000 to 119,999	107,147	49	809	138	1998	32.8%
126,000 to 138,999	135,942	55	849	157	1993	0.1%
139,000 to 151,000	147,211	54	899	152	1993	2.5%
151,000 to 171,000	159,288	56	904	154	1997	2.0%
						100.0%

Source: Compiled from U. S. Army Corps of Engineers, Navigation Data Center detailed records.

for the Texas City fleet is presented in Table 35. The world tanker fleet and, in particular, recent vessel buildings were examined to determine if Texas City's fleet better represent long-term expectations. For instance, the EGM shows an 80,000 DWT tankers with a design draft of 46 feet whereas for Texas City a design draft of 46 feet corresponds to a tankers DWT of 100,000. It was found that the Texas City fleet was indeed more representative of vessel fleet trends and, as a result, Texas City's drafts were used for the transportation cost calculations. Additionally and already noted to some extent, the tankers using Texas City tend to be relatively new and most appear to be double-hulled[12]. Again, the effect of the legislation is wider beams and this helps explain the difference between the EGM "representative vessels" and Texas City's fleet.

[12] The Oil Pollution Act of 1990 mandated that commencing in the year 2000, all Aframax and most Suezmax tankers without double bottoms or double sides that exceed 23 years of age will be barred from U.S. trade. An exemption to OPA 90 allows single-hull vessels to use U.S. deepwater ports or lightering areas until 2015.

Table 35
Comparison Between EGM Sample Vessel Characteristics and Vessels Used for Texas City Hourly Operating Cost Calculations

EGM Sample Vessels					Vessels Used for Texas City Calculations a/				
DWT	Design Draft (ft.)	Immersion Factor	LOA	Beam	DWT	Design Draft (ft.)	Immersion Factor	LOA	Beam
35,000	35	113	586	95	35,000	35	113	586	95
50,000	40	141	650	107	50,000	40	141	650	107
60,000	42	159	685	113	60,000	42	159	685	113
70,000	44	175	717	119	70,000	40	175	745	106
80,000	46	191	745	119	80,000	40	220	764	146
90,000	47	206	771	129	90,000	43	233	811	136
100,000	n/a	n/a	n/a	n/a	100,000	46	236	800	140
110,000	n/a	n/a	n/a	n/a	110,000	49	238	810	139
120,000	52	248	839	141	120,000	52	248	839	141
135,000	n/a	n/a	n/a	n/a	135,000	54	267	868	147
150,000	55	285	895	152	150,000	55	285	895	152
175,000	58	315	936	160	175,000	58	315	936	160

a/ Based on analysis of the world fleet and Texas City's recent historical fleet.

Comparative vessel design drafts between the Texas City and world fleet are presented in Tables 36 and 37. In order to better understand long-term effects, the vessel DWT and design draft relationship was further investigated with regard to vessel age. The results of this investigation indicated that Texas City's vessel DWT and design draft relationship better represented the characteristics of vessels likely to use Texas City during the next 10 to 15 years. The obvious effect of using relatively shallower and wider vessels are larger volumes per transit and lower per ton transportation cost within comparable draft ranges. Long-term fleet selection will continue to reflect goals of minimizing vessel operating costs.

Table 36
Crude Petroleum and Product Tankers
Tanker Vessels, Median Design Draft (feet)

DWT range	World Fleet (Vessels Built after 1995) Median Design Draft		Texas City Vessels Median Design Drafts for Crude & Product Tonnage	
	All Tankers	Product Tankers a/	Crude Oil Tankers	Product Tankers
8,000 to 47,998	34	37	33	35
47,999 to 59,999	38	43	41	41
60,000 to 69999	40	43	42	43
70,000 to 79,999	39	41	44	46
80,000 to 84,999	42	42	40	44
85,000 to 89,999	45	n/a	44	43
90,000 to 99,999	45	47	43	44
100,000 to 109,999	49	49	48	49
110,000 to 119,000	48	51	48	n/a
120,000 to 149,999	53	n/a	55	n/a
>=150,000	70	n/a	56	53

Source: U. S. Army Corps of Engineers, Navigation Data Center databases, 2000-03. Vessel characteristics obtained From current Fairplay/Lloyds Vessel Register CD, Summer 2005.

a/ excludes LNG and LPG and specialty tankers

Table 37
Texas City Crude Petroleum Imports
Average Yearly Tonnage for by DWT Range and Year Built
80,000 to 119,999 DWT Tanker Tonnage a/

DWT Range	Design Draft (ft)	Vessel Construction Year: 1985 or earlier	1986-1989	1990-1995	1996-2000	>=2001	Total (1000's) [a/]	% by DWT
		1000's of short tons (2000-03 Yearly Average)						
80,000 to 84,999	40	42	3,351	0	0	0	3,394	12%
85,000 to 89,999	43-44	1,826	1,212	408	0	0	3,446	13%
90,000 to 94,999	43	6	321	646	0	0	973	4%
95,000 to 99,999	44-45	0	154	5,918	1,471	0	7,543	28%
100,000 to 109,999	48	0	495	1,455	7,157	1,277	10,385	38%
110,000 to 119,999	49	0	0	193	875	399	1,468	5%
Yearly Average		1,875	5,533	8,620	9,503	1,677	27,208 [a/]	100%
% by Year Built		7%	20%	32%	35%	6%	100%	

[a/] Consists only of tonnage transported in 80,000 to 119,999 DWT tankers.
Source: U. S. Army Corps of Engineers, Navigation Data Center databases, 2000-03. Vessel characteristics obtained from current Fairplay/Lloyds Vessel Register CD, Summer 2005.

Underkeel Clearance

Underkeel clearance practices vary between companies and among ports. The analysis conducted for Texas City revealed a minimum of one foot was generally applicable; however, some companies require 3 feet. Actual underkeel clearance also varies annually due to the channel maintenance dredging cycle and weather conditions; however, tide is not a regular consideration for Texas City. Table 38 displays Texas City's 2001-03 vessel movements and percentage of movements by loaded draft. The effect of the dredging cycle interval results in a greater concentration of vessels loaded to 39 to 41 feet for the period closer to the completion of maintenance dredging. For purposes of analysis 3 feet of underkeel clearance was used for the without- and with project conditions.

Table 38
Texas City Ocean-Going Vessel Traffic
Number of Vessel Movements (Inbound and Outbound Trips) by Loaded Draft

Loaded Draft	2001	2002	2003	2001	2002	2003
(feet)	Number of Vessel Movements			% of Vessel Movements		
41	1	0	0	0.1%	0.0%	0.0%
40	50	28	27	4.6%	1.8%	1.8%
39	162	170	214	14.9%	11.2%	13.9%
38	140	125	101	12.9%	8.2%	6.6%
37	90	126	69	8.3%	8.3%	4.5%
36	57	52	137	5.3%	3.4%	8.9%
35	33	28	42	3.0%	1.8%	2.7%
18-34	551	993	950	50.8%	65.2%	61.7%
Total	1084	1522	1540	100.0%	100.0%	100.0%

Source: USACE, Waterborne Commerce of the U. S., Part 3, 1990-03.

Crude Petroleum Imports Transportation Savings Benefits

Transportation savings benefits from reductions in the vessel operating costs were calculated based on the relative difference in transportation costs between the without-project and with-project conditions. Transportation costs and savings were calculated for vessels that minimize transportation costs given trade route constraints. As previously noted, long-term fleet selection will continue to reflect goals of minimizing vessel operating costs. Table 39 summaries the transportation cost by trade route used to calculate the without- and with-project future conditions. The per ton transportation costs correspond to the least cost method of shipment associated with the particular trade route.

Review of the depths at trading ports and significant savings per ton indicates that nearly all crude petroleum from Mexico, Venezuela, and Trinidad would utilize 45 feet. An increase in Texas City's channel depth allows the existing range of 90,000 to 120,000 DWT vessels to carry approximately 20 percent more cargo, and the channel depths at the ports-of-origin are equipped to facilitate this transition. Expectations concerning the percentage of Middle East and Africa movements are subject to greater uncertainty. Nearly all Middle East tonnage is lightered and nearly all West Africa crude is lightened. The logistics associated with these offshore transfers introduces higher degrees of uncertainty than with direct shipment and, therefore, generates large cost variances. Additionally, and as the Table 39 presentation illustrates, the cost savings for offshore transfer is lower than with direct shipment; however, distinct cost savings are apparent.

Table 39
Texas City Crude Petroleum Imports
Transportation Cost and Savings, Most Likely Transportation Mode
Trade Route and Channel Depth

Trade Route/Depth	40 ft.	43 ft.	44 ft.	45 ft.	48 ft.	50 ft.
Mexico	Direct	Direct	Direct	Direct	Direct	Direct
cost/ton	$1.73	$1.57	$1.53	$1.49	$1.40	$1.36
savings/ton		$0.16	$0.20	$0.24	$0.33	$0.37
Venezuela & Trinidad a/	Direct	Direct	Direct	Direct	Direct	Direct
cost/ton	$3.74	$3.36	$3.26	$3.17	$2.95	$2.89
savings/ton		$0.38	$0.47	$0.57	$0.78	$0.85
W. Africa and North Sea	Lighten	Lighten	Lighten	Lighten	Direct	Direct
cost/ton	$8.52	$8.44	$8.41	$8.39	$8.20	$7.74
savings/ton		$0.08	$0.11	$0.13	$0.32	$0.77
Middle East	Lighter	Lighter	Lighter	Lighter	Lighter	Lighter
cost/ton	$11.41	$11.40	$11.20	$11.17	$11.15	$11.15
Savings/ton		$0.01	$0.21	$0.24	$0.26	$0.26

a/ Approximately 50% of 2001-03 Central and South America crude petroleum came from Venezuela and nearly all remaining 2001-03 Central and South America tonnage came from Trinidad. The EIA's 2006 forecast for 2010-30 shows the approximately 70% of Central and South America crude coming from Venezuela; the transportation savings calculations reflect this anticipated trend.

The savings for lightering movements result from increases in shuttles loads due to greater channel depth in Texas City. For lightering, the effect of increasing channel depths at Texas City allows for the reduction in the number of shuttles necessary to totally lighter a VLCC. The savings for lightened movements result from decreases in offshore unloading time from the mother vessel to shuttles. For lightening, the mother vessel is substituting offshore unloading time for dock-side unloading time. Additionally, the shuttle vessel reduces its overall loading and unloading time. Lightening generates comparatively lower savings than lightering because the latter produces the possibility of reducing the number of shuttles needed. Examination of the cost data also revealed that as channel depth increases the resulting savings may provide incentive to switch from lightening to direct shipment for movements from Africa and the North Sea. Table 40 presents the direct shipment cost for all routes. Comparison of the Africa/North Sea direct shipment cost (Table 40) with the lightening cost presented in Table 41 illustrates that this effect takes place at 48 feet. The lower the cost difference between direct versus offshore transfer costs, the higher the probability of direct shipment becomes. Alternatively, it was found that the efficiencies of offshore transfers are great and have increased in the last 10 to 15 years.

Table 40
Crude Petroleum Transportation Cost Per Ton for Direct Shipments to Texas City

Channel Depth	**40 ft.**	**43 ft.**	**44 ft.**	**45 ft.**	**48 ft.**	**50 ft.**
DWT	**Mexico to Texas City Cost Per Ton by Vessel Size (Direct)**					
80000	$1.60	$1.46	$1.46	$1.46	$1.46	$1.46
90000	$1.65	$1.51	$1.46	$1.42	$1.38	$1.38
100000	$1.73	$1.57	$1.52	$1.48	$1.37	$1.34
110000	$1.78	$1.61	$1.57	$1.52	$1.40	$1.34
120000	$1.91	$1.73	$1.68	$1.63	$1.50	$1.43
135000	$1.82	$1.66	$1.61	$1.57	$1.45	$1.39
150000	$1.79	$1.64	$1.59	$1.55	$1.43	$1.37
165000	$1.80	$1.64	$1.59	$1.55	$1.44	$1.37
175000	$1.84	$1.67	$1.63	$1.58	$1.46	$1.40
Venezuela and Trinidad to Texas City Cost Per Ton by Vessel Size (Direct)						
80000	$3.53	$3.19	$3.19	$3.19	$3.19	$3.89
90000	$3.65	$3.28	$3.18	$3.08	$2.99	$3.19
100000	$3.77	$3.39	$3.28	$3.18	$2.91	$2.99
110000	$3.89	$3.49	$3.38	$3.27	$2.99	$2.83
120000	$4.10	$3.67	$3.55	$3.43	$3.13	$2.83
135000	$3.86	$3.48	$3.37	$3.27	$2.99	$2.96
150000	$3.79	$3.42	$3.31	$3.21	$2.94	$2.84
165000	$3.80	$3.43	$3.32	$3.22	$2.95	**$2.79**
175000	$3.86	$3.47	$3.36	$3.25	$2.98	$2.79
West Africa and North Sea to Texas City Cost Per Ton by Vessel Size (Direct)						
80000	$10.24	$9.20	$9.20	$9.20	$9.20	$9.20
90000	$10.59	$9.47	$9.15	$8.85	$8.56	$8.57
100000	$10.90	$9.74	$9.40	$9.09	$8.27	$8.03
110000	$11.24	$10.02	$9.67	$9.35	$8.50	$8.01
120000	$11.70	$10.41	$10.05	$9.70	$8.80	$8.30
135000	$10.98	$9.82	$9.48	$9.17	$8.35	$7.89
150000	$10.76	$9.63	$9.30	$9.00	$8.20	$7.74
165000	$10.78	$9.64	$9.31	$9.00	$8.20	$7.74
175000	$10.89	$9.72	$9.38	$9.07	$8.25	$7.79
	Middle East to Texas City Cost Per Ton by Vessel Size Direct					
80000	$17.39	$15.61	$15.61	$15.61	$15.61	$15.61
90000	$17.99	$16.07	$15.51	$15.00	$14.52	$14.52
100000	$18.51	$16.51	$15.94	$15.40	$14.00	$13.59
110000	$19.08	$16.99	$16.39	$15.84	$14.37	$13.54
120000	$19.82	$17.61	$16.98	$16.39	$14.86	$13.99
135000	$18.57	$16.58	$16.01	$15.48	$14.08	$13.28
150000	$18.20	$16.25	$15.70	$15.18	$13.80	$13.03
165000	$18.23	$16.27	$15.71	$15.18	$13.80	$13.02
175000	$18.40	$16.39	$15.82	$15.28	$13.87	$13.08

Table 41
Texas City Crude Petroleum Imports
Lightened Cost Per Ton by Channel Depth and Trade Route

	Channel Depth (ft.) and Vessel DWT					
Mother Vessels (DWT)	**40 ft.**	**43 ft.**	**44 ft.**	**45 ft.**	**48 ft.**	**50 ft.**
Minimum	135,000	135,000	135,000	135,000	135,000	135,000
Maximum	175,000	175,000	175,000	175,000	175,000	183,000
Shuttle Vessels (DWT)						
Minimum	60,000	56,667	47,000	42,500	35,000	30,000
Maximum	85,000	72,500	70,000	65,000	56,667	56,667
W. Africa and North Sea	**Per Ton Transportation Cost to Texas City**					
Minimum	$8.11	$8.08	$8.06	$8.05	$8.05	$8.04
Mean	$8.52	$8.44	$8.41	$8.39	$8.38	$8.33
Maximum	$8.92	$8.80	$8.75	$8.73	$8.69	$8.62
Middle East	**Per Ton Transportation Cost to Texas City**					
Minimum	$12.34	$12.31	$12.29	$12.28	$12.28	$12.19
Mean	$12.75	$12.67	$12.64	$12.62	$12.62	$12.48
Maximum	$13.16	$13.03	$12.99	$12.96	$12.92	$12.77

Under the current and future without and with project conditions, the “mother” vessels offload partial cargoes to shuttle vessels and both vessels come into port. The lightened mother vessels were modeled in the ERDC ship simulation. These “lightened mother vessels” are the “design vessels”. The analysis for the offshore transfer process was based exclusively on operating costs. The duration of the transfer, number of shuttle tankers, supply boats, and equipment was estimated in terms of a “range of time” and the costs for vessels and equipment were determined. The shuttle vessel costs and additional pilot and tug charges were identified.

For the purpose of this analysis, transfers from lightening to direct shipment were not assumed to transpire for depths less than 48 feet. Comparison of the direct shipment cost for the Middle East (Table 40) with lightering cost presented in Table 42 shows that lightering is always the least cost shipping choice regardless of channel depth. Comparison of lightering cost for Africa and North Sea routings also illustrates that lightering would be the least cost alternative for that route; however, nearly all of Texas City’s tonnage for this group is from Africa and lightening is presently not an alternative, it may be in the future.

Table 42
Texas City Crude Petroleum Imports
Lightering Cost Per Ton by Channel Depth Alternative and Trade Route

Depth:	40 ft.	43 ft.	44 ft.	45 ft.	48 ft.	50 ft.
West Africa and North Sea Per Ton Transportation Cost						
Minimum	$8.11	$8.05	$8.05	$8.05	$8.07	$8.02
Mean	$8.51	$8.41	$8.40	$8.38	$8.38	$8.31
Maximum	$8.92	$8.77	$8.75	$8.72	$8.68	$8.60
Middle East Per Ton Transportation Cost						
Minimum	$12.34	$12.28	$12.28	$12.28	$12.30	$12.17
Mean	$12.75	$12.64	$12.63	$12.62	$12.61	$12.46
Maximum	$13.15	$13.01	$12.98	$12.95	$12.91	$12.75

As noted, direct shipment would not be the shipping method of choice for Middle East routings, and lightening is the least cost shipping method for Africa and North Sea tonnage and lightering is the least cost for Middle East routings. Table 43 summarizes the transportation cost savings based on the least cost shipping methods displayed in Table 39. The Table 43 presentation illustrates relatively significant changes in benefits between 43 and 44 feet is the result of a reduction in the number of shuttles needed to offload the contents of the mother vessel. The 44-foot depth allows for the reduction in 1 shuttle trip by lightering operation. The 45-foot depth also allows for some reduction. The increase in channel depth reduces the cost per ton for lightering by reducing the number of shuttle vessels to transport a given volume of crude oil.

Table 43
Texas City Crude Petroleum Imports
Annual Transportation Savings ($1,000's)
by Representative Trade Route and Decade
Channel Depth Alternative, Year, and Representative Origin

43-foot Channel	2000-03	2010	2020	2030	2040	2050	2060
Mexico	$1,493	$1,427	$1,679	$1,958	$2,183	$2,412	$2,664
Central/South America	$3,500	$3,988	$4,777	$5,713	$6,371	$7,038	$7,774
W. Africa & North Sea	$642	$999	$1,307	$1,612	$1,798	$1,986	$2,193
Middle East	$60	$72	$87	$106	$118	$131	$144
Total Savings	$5,695	$6,486	$7,850	$9,389	$10,471	$11,566	$12,776
44-foot Channel	2000-02	2010	2020	2030	2040	2050	2060
Mexico	$1,907	$1,823	$2,145	$2,501	$2,789	$3,081	$3,403
Central/South America	$4,417	$5,032	$6,028	$7,210	$8,040	$8,882	$9,811
W. Africa & North Sea	$736	$1,145	$1,499	$1,847	$2,060	$2,276	$2,514
Middle East	$2,396	$2,864	$3,436	$4,209	$4,694	$5,185	$5,728
Total Savings	$9,456	$10,864	$13,108	$15,767	$17,584	$19,424	$21,456
45-foot Channel	2000-02	2010	2020	2030	2040	2050	2060
Mexico	$2,289	$2,189	$2,575	$3,003	$3,349	$3,699	$4,086
Central/South America	$5,268	$6,002	$7,190	$8,599	$9,590	$10,594	$11,702
W. Africa & North Sea	$811	$1,261	$1,651	$2,035	$2,270	$2,507	$2,769
Middle East	$2,827	$3,379	$4,054	$4,965	$5,538	$6,117	$6,757
Total Savings	$11,196	$12,831	$15,470	$18,603	$20,747	$22,917	$25,315
48-foot Channel	2000-02	2010	2020	2030	2040	2050	2060
Mexico	$3,159	$3,020	$3,554	$4,144	$4,622	$5,105	$5,639
Central/South America	$7,305	$8,322	$9,969	$11,923	$13,297	$14,688	$16,225
Europe & Africa	$1,984	$3,086	$4,039	$4,979	$5,553	$6,134	$6,776
Middle East	$3,060	$3,657	$4,388	$5,374	$5,994	$6,621	$7,314
Total Savings	$15,508	$18,085	$21,950	$26,421	$29,466	$32,548	$35,954
50-foot Channel	2000-02	2010	2020	2030	2040	2050	2060
Mexico	$3,536	$3,381	$3,977	$4,638	$5,714	$5,714	$6,312
Central/South America	$7,888	$8,987	$10,766	$12,876	$14,360	$15,862	$17,522
Europe & Africa	$4,818	$7,494	$9,809	$12,093	$13,486	$14,897	$16,456
Middle East	$3,060	$3,657	$4,388	$5,374	$5,994	$6,621	$7,314
Total Savings	$19,302	$23,519	$28,940	$34,981	$39,554	$43,094	$47,603

Petroleum Product Transportation Savings Benefits

Reductions in the vessel operating costs for Texas City's foreign petroleum product imports and exports and coastwise shipments were calculated based on the relative difference in transportation costs between the without-project and with-project conditions. As with crude petroleum, transportation costs and savings were calculated for vessels that minimize transportation costs given trade route constraints. Again, long-term fleet selection will continue to reflect goals of minimizing vessel operating costs. Table 44 summaries the annual transportation savings benefits for petroleum product imports and exports. Table 45 summarizes the benefit calculations for coastwise product shipments.

Table 44
Texas City Petroleum Product Imports and Exports
Annual Transportation Savings ($1,000)
by Representative Trade Route and Decade

Trade Route and Year	2001-03	2010	2020	2030	2040	2050	2060
Europe and Africa (65%)	**43-foot Channel Imports Transportation Cost**						
Latin America (35%)	$683	$915	$1,198	$1,363	$1,550	$1,763	$2,005
	43-foot Channel Exports Transportation Cost						
(75% Europe/25% Brazil)	$146	$158	$166	$173	$179	$186	$193
Total Savings	$830	$1,073	$1,364	$1,535	$1,729	$1,949	$2,199
Europe and Africa (65%)	**44-foot Channel Imports Transportation Cost**						
Latin America (35%)	$894	$1,195	$1,563	$1,778	$2,023	$2,302	$2,619
	44-foot Channel Exports Transportation Cost						
(75% Europe/25% Brazil)	$187	$202	$212	$221	$229	$238	$247
Total Savings	$1,081	$1,397	$1,775	$1,999	$2,252	$2,540	$2,867
Europe and Africa (65%)	**45-foot Channel Imports Transportation Cost**						
Latin America (35%)	$1,077	$1,440	$1,884	$2,143	$2,438	$2,774	$3,156
	45-foot Channel Exports Transportation Cost						
(75% Europe/25% Brazil)	$225	$243	$256	$266	$276	$287	$298
Total Savings	$1,302	$1,683	$2,139	$2,409	$2,714	$3,061	$3,454
Europe and Africa (65%)	**48-foot Channel Imports Transportation Cost**						
Latin America (35%)	$1,563	$2,090	$2,735	$3,111	$3,540	$4,027	$4,582
	48-foot Channel Exports Transportation Cost						
(75% Europe/25% Brazil)	$324	$350	$368	$382	$397	$412	$428
Total Savings	$1,887	$2,440	$3,102	$3,493	$3,936	$4,439	$5,010
Europe and Africa (65%)	**50-foot Channel Imports Transportation Cost**						
Latin America (35%)	$1,563	$2,090	$2,735	$3,111	$3,540	$4,027	$4,582
	50-foot Channel Exports Transportation Cost						
(75% Europe/25% Brazil)	$324	$350	$368	$382	$397	$412	$428
Total Savings	$1,887	$2,440	$3,102	$3,493	$3,936	$4,439	$5,010

Table 45
Petroleum Product Coastwise Shipments
Vessel Data, Base Tonnage, and Transportation Savings Benefit Summary

Origin-Destination Data

Shipments to Pt Everglades from Texas City

Initial % of total outbound shipments: 10.0%

Round trip mileage: 2,450

Vessel Input Data and Transportation Cost

Channel Depth (ft)	Design Draft (ft)	Vessel DWT	No. of feet Light-Loaded	Cargo by Channel Depth	Round Trip Voyage Cost	Loading and Unloading Cost	Tug Cost	Total Cost	Cost Per Ton
40	43	45000	6	30,871	$272,541	$16,947	$7,319	$296,807	$9.61
45	43	45000	2	37,890	$272,541	$20,800	$7,422	$300,763	$7.94
								Saving/ton	$1.68

Texas City Domestic Coastwise Petroleum Product Tonnage

Year	Total Short Tons	Short Tons Used for Benefits
2001	4,590,136	459,014
2002	3,091,890	309,189
2003	3,962,795	396,280
2001-03 Average		388,161
% of Total		10%

Texas City Domestic Coastwise Petroleum Product Annual Transportation Benefits

Year	Total Tonnage	Used for Benefits	Percentage Used for Benefits	Annual Savings
2001/03	3,881,607	388,161	10%	$650,858
2010	4,304,147	430,415	10%	$721,709
2020	4,897,580	979,516	20%	$1,642,429
2030	5,572,833	1,114,567	20%	$1,868,878
2040	6,341,186	1,268,237	20%	$2,126,549
2050	7,215,475	1,443,095	20%	$2,419,746
2060	8,210,307	1,642,061	20%	$2,753,368

Summary of Average Annual Benefits and Costs

Table 46 presents the transportation cost savings for crude petroleum and petroleum product imports. These 2 commodity groups comprise 95 percent of total deepening benefits. The remaining 5 percent are for coastwise product shipments. Table 47 summarizes the benefit cost analysis, including the first cost of construction, net excess benefits, and the benefit-to-cost ratio. The first cost shown in Table 47 was calculated based on a fuel cost of $1.12 per gallon. The 50-foot channel depth provides the highest net excess benefits. The 45-foot channel alternative is the locally preferred plan.

Table 46
Transportation Savings ($1000) by Channel Depth and Commodity Group

		Crude Petroleum Imports			
		Transportation Savings by Channel Depth 2010-2060			
Year	43	44	45	48	50
2010	$6,486	$10,864	$12,831	$18,085	$23,519
2020	$7,850	$13,108	$15,470	$21,950	$28,940
2030	$9,389	$15,767	$18,603	$26,421	$34,981
2040	$10,471	$17,584	$20,747	$29,466	$39,554
2050	$11,566	$19,424	$22,917	$32,548	$43,094
2060	$12,776	$21,456	$25,315	$35,954	$47,603
		Average Annual Benefits (50-Year Project Life at 4.875%)			
2010-60	$8,571	$14,362	$16,950	$24,032	$31,743
		Petroleum Product Import and Export Tonnage (Includes Coastwise Domestic)			
		Transportation Savings by Channel Depth 2010-2060			
Year	43	44	45	48	50
2010	$1,795	$2,119	$2,405	$3,162	$3,587
2020	$3,006	$3,418	$3,782	$4,745	$5,286
2030	$3,404	$3,868	$4,278	$5,362	$5,972
2040	$3,856	$4,379	$4,841	$6,063	$6,750
2050	$4,369	$4,960	$5,480	$6,859	$7,634
2060	$4,952	$5,620	$6,207	$7,763	$8,638
		Average Annual Benefits (50-Year Project Life at 4.875%)			
2010-60	$3,052	$3,487	$3,872	$4,889	$5,461
		Total Average Annual Benefits (50-Year Project Life at 4.875%)			
Total	$11,623	$17,849	$20,822	$28,921	$37,203

Table 47
Economic Summary Data at 4.875%
($1000)

Channel Depth (ft):	43	44	45	48	50
First Cost of Construction a/	$34,219	$42,446	$52,652	$107,087	$145,065
Period of Construction	24	24	24	48	60
Interest During Construction Period	$1,647	$2,043	$2,535	$10,890	$18,833
Non-Federal Associated Cost	$2,133	$2,347	$2,581	$2,839	$3,123
Archaeology Mitigation Cost	$1,108	$1,108	$1,108	$1,108	$1,108
Total Project Construction Cost	$39,131	$47,968	$58,899	$121,972	$168,189
Average Annual Construction Cost	$2,102	$2,577	$3,164	$6,553	$9,036
Average Annual O&M Incremental Cost	$139	$139	$139	$2,000	$4,000
Total Average Annual Cost	$2,241	$2,716	$3,303	$8,553	$13,036
Average Annual Benefits	$11,623	$17,849	$20,822	$28,921	$37,203
Net Excess Benefits	$9,382	$15,133	$17,518	$20,369	$24,168
BCR	5.2	6.6	6.3	3.4	2.9

a/ Calculated Using $1.12 per gallon fuel cost.

Sensitivity Analyses

Sensitivities were evaluated for tonnage growth and vessel underkeel clearance. The sensitivity effects were assessed in relationship to the net excess benefits summarized in the bottom portion of Table 47.

Tonnage Forecast Sensitivity. The project benefit estimates were reevaluated using alternative crude and petroleum product import forecasts. Two of the alternative forecasts used are the Petroleum Industry Research Associates, Inc. (PIRA) and Global Insight projections. These alternatives, along with the EIA AEO2006 reference forecast, are displayed in Table 48. As shown, the EIA reference and Global Insight 2004-30 compound annual growth rates of 1 percent for U. S. crude petroleum imports are higher than PIRA's growth rate of 0.4 percent. For petroleum products imports, EIA reference and Global Insight shows respective compound annual growth of 2.3 and 5.1 percent for 2004-30 and PIRA shows zero growth. The effect of these growth rates were evaluated and compared with the Texas City's baseline forecast application summarized in Table 47. As discussed earlier, Texas City's baseline forecast incorporates using 1975-2003 U. S. crude petroleum imports and year as independent variables and Texas City tonnage as the dependent variable[13]. An additional equation, using U. S. imports

[13] Table 13 presents the EIA AEO 2006 reference case Texas City application, and Table 14 presents the regression equation.

as the sole independent variable, was evaluated as well. The output statistics associated with the latter were somewhat weaker with higher residuals than when both U. S. imports and year were used. Another alternative, a relatively basic methodology, is to simply apply the EIA 2003-2030

Table 48
Comparison of Petroleum Forecasts, 2004-30
(Millions of barrels per day)

Forecaster	2004	2015	2030	Average Annual Growth Rate
	Crude Petroleum Imports			
EIA Reference	10.06	10.47	13.51	1.1%
PIRA Energy Group	10.06	9.65	11.24	0.4%
Global Insight	10.06	11.28	13.01	1.0%
	Petroleum Product Imports			
	2004	2015	2030	
EIA Reference	2.05	2.76	3.73	2.3%
PIRA Energy Group	2.05	2.22	2.04	0.0%
Global Insight	2.05	4.22	7.44	5.1%

Source: U. S. Department of Energy, Energy Information Administration, December 2005, p. 115.

growth rates to Texas City's recent tonnage. Use of this growth rate application assumes that Texas City imports will grow at exactly the same rate as U.S. imports. This forecast generates greater uncertainty than the regression based forecast due to utilization of a specific base point. Table 49 displays comparison of Texas City's crude petroleum import forecast using various base year selections; the regression based forecast is also shown. The regression based forecast, which is displayed for comparison in the bottom right column of Table 59, is statistically strong. The obvious weakness of regression based forecasts is unforeseen structural changes in the U.S. economy and the PIRA forecast reflects that possibility. As previously discussed, Texas City's import trends exhibited higher growth rates than either the nation or the U. S. Gulf Coast Petroleum Administration District (PADD III), Texas City's 1999-03 average annual growth for crude petroleum imports is 12 percent per annum while U. S. and PADD III respective rates are 3 percent and 1 percent. Evaluation of Texas City growth rates for the 1985- and 1990-03 expanded period also reveal long-term growth exceeding national and regional rates. Analysis of the historical trend suggests that Texas City growth will be somewhat higher than the U. S. or PADD III rates and, therefore, use of a long-term regression equation base helps to address issues associated with base year determination.

Table 49
U. S. EIA Forecast and Texas City Application

Year	Millions of Barrels Per Day	1000's of Barrels	1000's of Short tons
U. S. Crude Petroleum Imports (Base Data) a/			
2001	10.00	3,404,894	479,318
2002	10.20	3,336,175	486,249
2003	9.65	3,527,696	515,747
2004	10.09	3,692,063	
2010	10.05	3,677,426	530,485
2020	11.26	4,120,181	594,354
2030	13.51	4,943,486	713,119

Texas City Crude Petroleum Imports
1000's of short tons

Year	Short Tons
2001	38,688
2002	32,897
2003	38,773
2004	42,845

Texas City (1000's of short tons)
Application of Alternative Forecasts
Crude Petroleum Imports

	Growth Rate Application			Regression Based Forecast
Base Year	2001-03	2003	2004	n/a
Base Year Tonnage	39,521	38,773	42,845	n/a
2010	44,279	40,419	42,675	43,680
2020	53,127	45,285	47,813	53,246
2030	39,521	54,334	57,367	64,351

a/ The historical time series data displayed at the EIA websites is generally presented in thousands of barrels, while the EIA forecast volumes are generally presented in millions barrels per day. The regression equations were prepared using the historical time series data. U. S. imports are shown in barrels, BPD, and short tons to aid in data tracking.

Summarization of the effects of the alternative forecasts on the net excess benefits and benefit-cost ratios are displayed in Table 50. Table 51 displays comparison of the recommended plan with 2003 based "no growth forecasts". The no growth scenario assumes major changes in social-political circumstances and phasing out of crude petroleum.

Table 50
Economic Summary Data at 4.875 %
Using Comparative Forecasts (Dollars in 1000's)

	Texas City Project Cost
Channel Depth	45 feet
First Cost of Construction	$52,652
Interest During 2-Year Construction Period	$2,535
Non-Federal Associated Cost	$2,581
Archaeology Mitigation Cost	$1,108
Total Project Construction Cost	$58,899
Average Annual Construction Cost	$3,164
Average Annual O&M Incremental Cost	$139
Total Average Annual Cost	$3,303

Texas City Channel
Application of Alternative Forecasts for
Crude Petroleum and Petroleum Product Imports a/

	PIRA	Global Insights	EIA Reference	Direct Application of Growth Rates c/	
Forecast	Regression Based Forecasts b/			EIA Reference	PIRA
Average Annual Benefits	$17,959	$23,662	$20,822	$17,067	$14,811
Net Excess Benefits	$14,656	$20,358	$17,486	$13,764	$11,508
B/C Ratio	5.4	7.2	6.3	5.2	4.5

a/ An additional sensitivity using foreign-flag tanker costs for U. S. coastwise product shipments was also evaluated but is not shown in this table. The affect of using foreign-flag tankers instead of U. S. flag tankers reduces the average annual benefits by approximately 3 percent and, therefore does not have an effect on average annual benefits.
b/ Forecasts were prepared using regression equation of Texas City imports as a function of U. S. Imports and Year. Table 13 shows the equation.
c/ Direct application forecasts were prepared by applying the national forecast growth rates to Texas City's 2001-03 average tonnage. The years 2001-03 were used for the U. S. total base tonnage.

Table 51
Economic Summary Data at 4.875 %
Comparison of Recommended Plan with No Growth Tonnage-Based Forecast
(Dollars in 1000's)

	Base Plan From Table 46	2003 Tonnage Volumes	Declining Petroleum Volumes a/
Channel Depth	45 ft.	45 ft.	45 ft.
First Cost of Construction	$52,652	$52,652	$52,652
Interest During Construction	$2,535	$2,535	$2,535
Non-Federal Associated Cost	$2,581	$2,581	$2,581
Archaeology Mitigation Cost	$1,108	$1,108	$1,108
Total Project Construction Cost	$58,899	$58,899	$58,899
Average Annual Construction Cost	$3,164	$3,164	$3,164
Average Annual O&M	$139	$139	$139
Total Average Annual Cost	$3,303	$3,303	$3,303
Average Annual Benefits	$20,822	$15,314	$13,537
Net Excess Benefits	$17,518	$12,011	$10,234
B/C Ratio	6.3	4.6	4.1

a/ Petroleum tonnage declines approximately 1.1 percent per annum.

Vessel Underkeel Clearance Sensitivity. The Texas City Vessel Pilots were again consulted to help in understanding vessel underkeel clearance practices. While the pilots' general policy is to allow a maximum loaded draft of 39.6 feet mean low tide, they will consider deeper loaded drafts or restrict vessels to something less depending on tide, current, and winds, and vessel conditions. Underkeel calls are made on a case-by-case basis and the specifics for a reoccurring vessel will vary on a daily/hourly basis. Decisions are largely dependent upon weather and tide conditions. Additionally, while one company is strict about using 3 feet of clearance, the effect of 3-foot underkeel does not necessarily mean that their vessels are loaded to 37 feet, but rather that there is at least 3 feet between the keel and the controlling channel depth. Controlling channel depth may range from 39 to 44 feet, with the variance being dependent on the point within the channel maintenance dredging cycle.

As a basis for pilot discussion, Tables 52 and 53 were prepared. Table 52 shows 2001-04 annual crude petroleum import tonnage by loaded draft. The data presented was compiled from the Corps detailed waterborne commerce database and it differs from the information presented in

Table 52
Texas City Channel
Percentage of Crude Petroleum Import Tonnage by Loaded Draft (ft)

Loaded Draft (ft)	2001	2002	2003	2004
<=34	24.3%	18.8%	32.9%	25.9%
37	12.5%	20.9%	6.7%	7.9%
38	22.7%	22.8%	16.1%	15.6%
39	30.6%	33.2%	39.4%	45.9%
40	9.9%	4.2%	4.8%	4.7%
Weighted Draft (ft)	37.3	37.4	37.0	37.3

Source: USACE, Waterborne Commerce of the U. S., detailed database.

Table 53
Texas City Channel Minimum Depths (Mean Low Tide in feet)
Reach leading to the TC Turning Basin and Crude Oil Docks

Date	Left Outside	Left Inside	Right Inside	Right Outside
Minimum Between Cross-Sections 30+000 and 3+400				
September 2001	39.09	43.38	44.06	42.10
December 2002	34.80	42.63	41.57	38.10
July 2003	32.40	40.80	39.56	35.83

Source: USACE, Galveston District, Operations Branch.

the gray book (IWR-WCUS) in that the gray book presentation is based on vessel trips and is not commodity specific. The database has the advantage of allowing for isolation of specific vessel records. A short-coming of the foreign cargo database is that it is organized by commodity and while trip counts can be estimated from the data presented, a specific trip field is not contained in the database.

Table 53 shows the controlling channel depth for three distinct survey periods. Most vessel operators and pilots rely on the “inside depths” shown in Table 53 as a primary variable in deciding whether to allow vessel transit; however, the outside depth was noted as a consideration for some operators. Again, it was emphasized that decisions varies on a daily and sometimes hourly basis.

During winter months, vessels are routinely loaded ½ to 1-foot lighter than during other seasons. The practice of lighter winter loads is done to avoid delays due to waiting for higher tides or a return to prevailing southeast winds. In helping to understand the channel depths shown in Table 53, the operators noted that 39.56 feet shown for July 2003 for the right inside channel probably equates to 38.6 feet salt water. A depth of 39.6 feet in salt water generally corresponds to 40.6 feet in the relative brackish water of the Texas City Channel. It is understood that the vessel drafts are recorded at the dock; however, the precision of the data is subject to some level of variance and uncertainty. For instance, the gray book records show a few vessel transits at 41 feet but the detailed database does not show any loaded drafts greater than 40 feet. Adding to potential variability it was noted that vessels burn off bunker fuel while in-transit and this results in reductions in vessel draft readings.

While the vessel operators emphasized that the Table 52 and 53 data are not comparative, it was agreed that the vessels with 40-foot loaded drafts shown in Table 52 generally have a minimum of 1-foot underkeel clearance and, therefore, are operating on a channel with a mean low tide of 41 feet or more. Additionally, it was noted that vessels showing loaded drafts of 40 feet may have 4 feet underkeel at some point during any given year while only having one foot at other times. The variance is dependent on the point within the maintenance dredging cycle and weather, wind, and tide conditions. Discussion with the vessel operators suggested that one foot of underkeel was not as likely as 2 or more. Records showing loaded drafts of 40 feet tend to be associated with high tides or a recently completed dredging channel scenario. The operators are risk adverse and loading to maximum channel capacity may not only result in vessel and property damages but may also result in significant delays due to waiting upon a one-foot tidal increase. It was also emphasized that a 5-foot increase in channel depth would result in a 5-foot increase in average loaded drafts. Throughout the discussions, it was also emphasized that the loaded drafts shown in Table 52 do not provide much, if any, indication of underkeel clearance.

While the pilots did not provide conclusive indications of the most likely underkeel clearance, they concurred that the minimum underkeel clearance was one foot and the most common was more than one foot. Given this variability the effect of an underkeel clearance range between zero and four feet was subsequently reviewed to help determine resulting degrees of change in the annual transportation savings estimates. Table 54 summaries the results of this exercise. The presentation reveals surprisingly, but relatively, small changes in transportation cost savings. The irregular variability between underkeel and transportation savings relates to relatively inefficient vessel size for shuttle vessel selection. For instance, a one-foot increase or decrease in underkeel clearance may result in a slightly smaller or larger shuttle size, which in turn may generate increases or decreases in cost per ton efficiencies. Economic theory suggests that vessel size selection will gravitate to the most efficient vessel sizes. Transitions in the shuttle vessel fleet will be a likely outcome to changes in channel depth and any subsequent changes in operating practices such as underkeel clearance.

Table 54
Texas City Channel
Comparison of Average Annual Benefits
Underkeel Clearance Sensitivity

Feet of Underkeel Clearance	Average Annual Transportation Savings Benefits ($1,000's) at 4.875%
0	$18,829
1	$17,802
2	$19,238
3	$20,789
4	$21,813

In addition to running various underkeel clearance scenarios, a 42.5 foot without project condition was compared to a 47.5 foot with project condition. The basis for this exercise is that vessel operators have additional channel depth available after channel maintenance. The purpose of this comparison was to help determine how the relative difference in transportation savings between authorized project depths of 40 and 45 feet versus 42.5 and 47.5, with the latter depths being available during various periods. This analysis was performed using 3-foot of underkeel. The results showed annual savings 2 percent less than the savings between the 40- and 45-foot depths shown for the base plan in Table 47. The results of the underkeel sensitivity analyses suggest that the project benefit estimates presented in Table 47 provide a generally reasonable base.

APPENDIX B

Real Estate Appendix

1. General Background: The Texas City Channel Deepening Project was authorized under Section 201 of the Water Resources Development Act (WRDA) of 1986, Public Law 99-622, dated 17 November 1986. The existing navigation project is a 40-foot deep, 400-foot wide channel, from the Texas City Turning Basin to the Houston Ship Channel. A 50-foot project was authorized under WRDA 1986, but was never constructed because the project sponsor, the city of Texas City was unable to secure funding to initiate plans and specifications in 1989. In recent years the size and draft of vessels using the Texas City Channel have increased to meet the competitive demand for more efficient movements of bulk commodities, in particular crude petroleum and petroleum products. In 2001, the City requested that channel be deepened to 45 feet to accommodate that demand. The City did not request deepening the channel to the authorized depth of 50 feet due to potential high project costs and environmental concerns.

2. Project Location. The project is located in Galveston County, Texas. The Texas City Channel is located on the upper Texas coast extending from the Galveston Bay mainland shoreline at Texas City, through the jettied Galveston Entrance Channel, to deep water in the Gulf of Mexico. Galveston Bay is the largest estuarine system on the Texas coast and provides access to the principal ports of Houston, Texas City and Galveston.

3. Project Description. The Texas City Channel begins at Bolivar Road / Houston Ship Channel and continues to the Texas City Turning Basin, 6.7 miles. The Recommended Plan proposes to deepen the channel to 45 feet and widen in incidental areas. It also proposes to construct several beneficial use sites using dredged material. PAs 2A, 2B and 2C are located along the north flank of the Texas City Dike. The material dredged from the channel will be distributed into the surf to nourish the beach in this area. PAs 5 and 6 are two cells located on the existing Shoal Point PA. The Shoal Point PAs (SPPA) are available by virtue of Navigation Servitude. PAs SPPA 1 thru 5 will utilize dredged material beneficially are intended to create intertidal marsh habitat. These sites are all adjacent to Shoal Point in navigable waters (Plate 1).

4. Real Estate Requirements. The Texas City Channel will be dredged to a depth of 45 feet; new work dredging will take place from the Texas City Turning Basin to the Houston Ship Channel. All of the proposed dredging will be performed within navigable waters. All of the proposed PAs identified for this project are all subject to the Government's use of Navigation Servitude, a right that stems from the Commerce Clause of the Constitution which gives the Government the right to use navigable waters in aid of navigation without compensation. Therefore, no real estate interests will be required. The controlling agency is the U.S. Army Corps of Engineers.

5. Borrow Material. There are no real estate needs for borrow material because borrow material would be obtained from channel construction and maintenance and from disposal areas.

6. Access/Staging Area. The Recommended Plan does not require any Access/Staging Areas. All of the proposed work will be performed within the existing right-of-way of the Texas City Channel. There is an existing public road to the Shoal Point PA and all other PAs are accessible by water only.

7. Recreation Features. There are no recreation features for the Recommended Plan.

8. Induced Flooding. There will be no induced flooding by virtue of the construction of the project. The proposed deepening and incidental widening of the channel will be constructed within navigable waters, in the existing channel.

9. Mitigation. The recommended plan contains no mitigation features. Dredged material excavated from the proposed project channel will be used beneficially to create 5 marsh sites. Navigation Servitude will be invoked since construction of these sites all fall within navigable waters of the US.

10. Federally Owned Land & Existing Federal Project. There are no federally owned lands within the Recommended Plan, however, the existing Texas City Channel is a Federally authorized 40-foot project which was completed in June 1967.

11. Project Sponsor Owned Land. The City of Texas City, sponsor for the project has approximately 350 acres they own in fee on Shoal Point PA.

12. Navigation Servitude. The entire project falls within the Navigable waters of the United States, therefore, no real estate acquisition or credits will be required.

13. Public Law 91-646 Relocations. There are no residential houses, businesses, or farms that would be required for relocation associated with PL 91-646.

14. Assessment of Project Sponsor Land Acquisition Capabilities. The local sponsor, the City of Texas City, has the authority and capability to furnish lands, easements and rights of way required by the Project Cooperation Agreement (PCA).

15. Baseline Cost Estimate for Real Estate. The Real Estate cost estimate reflects the estimated Federal cost for the project. These costs include team meetings, mapping of project, data maintenance, supervision and administrative costs. The real estate costs for the proposed project is $22,000.00.

16. Acquisition Schedule. There is no acquisition plan because the entire Recommended Plan falls within existing Rights-Of-Ways and PAs that are available by virtue of Navigation Servitude.

17. Mineral Activity. There are no active petroleum wells in the project alignment and PAs.

18. <u>Facilities/Utilities Relocations.</u> There are no known facilities or utilities to be relocated within the project area. Two pipelines exist under the proposed project. One is an abandoned line and the other line is at a substantial depth that the project dredging will not affect the pipe.

19. <u>HTRW or Other Environmental Contaminants.</u> There are no known hazardous or toxic wastes or other environmental contaminants on or within the project work area.

20. <u>Attitudes of the Landowner.</u> The City of Texas City and the U.S. Government are owners of the majority of the project lands. As owners they are supportive and in favor of the project. No resistance to the project by the landowners is expected.

APPENDIX C

Evaluation of Section 404(b)(1) Guidelines
(Short Form)

	Yes	No*
1. Review of Compliance (230.10(a)-(d))		
A review of the proposed project indicates that:		
a. The placement represents the least environmentally damaging practicable alternative and, if in a special aquatic site, the activity associated with the placement must have direct access or proximity to, or be located in the aquatic ecosystem, to fulfill its basic purpose (if no, see section 2 and information gathered for EA alternative).	**X**	
b. The activity does not appear to:		
1) Violate applicable state water quality standards or effluent standards prohibited under Section 307 of the Clean Water Act;	**X**	
2) Jeopardize the existence of Federally listed as threatened or endangered species or their habitat; and	**X**	
3) Violate requirements of any Federally designated marine sanctuary (if no, see section 2b and check responses from resource and water quality certifying agencies).	**X**	
c. The activity will not cause or contribute to significant degradation of waters of the U.S. including adverse effects on human health, life stages of organisms dependent on the aquatic ecosystem, ecosystem diversity, productivity and stability, and recreational, aesthetic, an economic values (if no, see values, Section 2)	**X**	
d. Appropriate and practicable steps have been taken to minimize potential adverse impacts of the discharge on the aquatic ecosystem (if no, see Section 5)	**X**	

	Not Applicable	Not Significant	Significant*
2. Technical Evaluation Factors (Subparts C-F) (where a 'Significant' category is checked, add explanation below.)			
a. Physical and Chemical Characteristics of the Aquatic Ecosystem (Subpart C)			
1) Substrate impacts		**X**	
2) Suspended particulates/turbidity impacts		**X**	
3) Water column impacts		**X**	
4) Alteration of current patterns and water circulation		**X**	
5) Alteration of normal water fluctuation/hydroperiod	**X**		
6) Alteration of salinity gradients		**X**	

b. Biological Characteristics of the Aquatic Ecosystem (Subpart D)			
1) Effect on threatened/endangered species and their habitat		**X**	
2) Effect on the aquatic food web		**X**	
3) Effect on other wildlife (mammals, birds, reptiles and amphibians)		**X**	
	Not Applicable	**Not Significant**	**Significant***
2. Technical Evaluation Factors (Subparts C-F) (where a 'Significant' category is checked, add explanation below.)			
c. Special Aquatic Sites (Subpart E)			
1) Sanctuaries and refuges	**X**		
2) Wetlands	**X**		
3) Mud flats	**X**		
4) Vegetated shallows	**X**		
5) Coral reefs	**X**		
6) Riffle and pool complexes	**X**		
d. Human Use Characteristics (Subpart F)			
1) Effects on municipal and private water supplies	**X**		
2) Recreational and Commercial fisheries impacts		**X**	
3) Effects on water-related recreation		**X**	
4) Aesthetic impacts		**X**	
5) Effects on parks, national and historical monuments, national seashores, wilderness areas, research sites, and similar preserves	**X**		

	Yes
3. Evaluation of Dredged or Fill Material (Subpart G)	
a. The following information has been considered in evaluating the biological availability of possible contaminants in dredged or fill material (check only those appropriate)	
1) Physical characteristics	**X**
2) Hydrography in relation to known or anticipated sources of contaminants	**X**
3) Results from previous testing of the material or similar material in the vicinity of the project	**X**
4) Known, significant sources of persistent pesticides from land runoff or percolation	
5) Spill records for petroleum products or designated (Section 311 of Clean Water Act) hazardous substances	**X**

6) Other public records of significant introduction of contaminants from industries, municipalities or other sources	**X**
7) Known existence of substantial material deposits of substances which could be released in harmful quantities to the aquatic environment by man-induced discharge activities	**X**

List appropriate references:

1) U.S. Army Corps of Engineers Final Environmental Impact Statement for Texas City's Proposed Shoal Point Container Terminal Project, November 2002

	Yes	**No**
b. An evaluation of the appropriate information in 3a above indicates that there is reason to believe the proposed dredged or fill material is not a carrier of contaminants, or that levels of contaminants are substantively similar at extraction and placement sites and not likely to degrade the placement sites, or the material meets the testing exclusion criteria.	**X**	

	Yes
4. Placement Site Delineation (230.11(f))	
a. The following factors as appropriate, have been considered in evaluating the placement site:	
1) Depth of water at placement site	**X**
2) Current velocity, direction, and variability at placement site	**X**
3) Degree of turbulence	**X**
4) Water column stratification	**X**
5) Discharge vessel speed and direction	**NA**
6) Rate of discharge	**X**
7) Fill material characteristics (constituents, amount, and type of material, settling velocities)	**X**
8) Number of discharges per unit of time	**NA**
9) Other factors affecting rates and patterns of mixing (specify)	**X**

List appropriate references:

	Yes	No
b. An evaluation of the appropriate factors in 4a above indicates that the placement site and/or size of mixing zone are acceptable.	X	

	Yes	No
5. Actions to Minimize Adverse Effects (Subpart H)		
All appropriate and practicable steps have been taken, through application of recommendations of 230.70-230.77 to ensure minimal adverse effects of the proposed discharge.	X	

List actions taken:

1) Control the speed of the dredge and discharge to minimize loss of material.

	Yes	No*
6. Factual Determination (230.11)		
A review of appropriate information as identified in items 2-5 above indicates that there is minimal potential for short- or long-term environmental effects of the proposed discharge as related to:		
a. Physical substrate at the placement site (review Sections 2a. 3, 4, and 5 above)	X	
b. Water circulation, fluctuation and salinity (review Sections 2a. 3, 4, and 5)	X	
c. Suspended particulates/turbidity (review Sections 2a. 3, 4, and 5)	X	
d. Contaminant availability (review Sections 2a. 3, and 4)	X	
e. Aquatic ecosystem structure and function (review Sections 2b and c, 3, and 5)	X	
f. Placement site (review Sections 2, 4, and 5)	X	
g. Cumulative impacts on the aquatic ecosystem	X	
h. Secondary impacts on the aquatic ecosystem	X	

7. Evaluation Responsibility	
a. This evaluation was prepared by:	**Kristy Morten**
Position:	**Environmental Specialist**

8. Findings	Yes
a. The proposed placement site for discharge of or fill material complies with the Section 404(b)(1) Guidelines.	X
b. The proposed placement site for discharge of dredged or fill material complies with the Section 404(b)(1) Guidelines with the inclusion of the following conditions:	

List of conditions:

c. The proposed placement site for discharge of dredged or fill material does not comply with the Section 404(b)(1) Guidelines for the following reason(s):	
1) There is a less damaging practicable alternative	
2) The proposed discharge will result in significant degradation of the aquatic ecosystem	
3) The proposed discharge does not include all practicable and appropriate measures to minimize potential harm to the aquatic ecosystem	

______________________ Date	____ CAROLYN MURPHY Chief, Environmental Section

NOTES:

* A negative, significant, or unknown response indicates that the permit application may not be in compliance with the Section 404(b)(1) Guidelines.

Negative responses to three or more of the compliance criteria at the preliminary stage indicate that the proposed projects may not be evaluated using this "short form" procedure. Care should be used in assessing pertinent portions of the technical information of items 2a-e before completing the final review of compliance.

Negative response to one of the compliance criteria at the final stage indicates that the proposed project does not comply with the Guidelines. If the economics of navigation and anchorage of Section 404(b)(2) are to be evaluated in the decision-making process, the "short form" evaluation process is inappropriate.

APPENDIX D

Air Conformity Analysis

A General Air Conformity Analysis to determine potential air quality impacts is being conducted. When the air conformity analysis is completed, the analysis will be coordinated under a separate notice and the entire analysis will be located in this section in the Final Environmental Assessment.

APPENDIX E

Agency Coordination/Consultation Letters

United States Fish and Wildlife Service

From: Moni_Belton@fws.gov
Sent: Wednesday, December 06, 2006 3:34 PM
To: Morten, Kristy L SWG
Subject: Re: FW: TX City PDT Meeting

Kristi,
The USFWS agreed to provide a planning aid letter according to the SOW dated FY 2005/2006. The decision to provide a planning aid letter was based on the amount of USFWS involvement with the USACE throughout the development of the Texas City Shoal Point Container Terminal (TCSPCT) Project and Environmental Impact Statement. It was our understanding the current Federal Project to deepen the Texas City Channel would use this document as a guide and include USFWS recommendations made for the TCSPCT project. We have been attending meetings and providing recommendations when needed. If a CAR is required, additional funding will be needed to ensure appropriate staff time from the USFWS Clear Lake ES field office.
Thank you,
Moni

Moni DeVora Belton
Fish and Wildlife Biologist
USFWS Ecological Services
17629 El Camino Real
Suite 211
Houston TX 77058-3051
281-286-8282
281-488-5882 fax

Texas Parks and Wildlife Department

From: Stephanie Shelton [Stephanie.Shelton@tpwd.state.tx.us]
Sent: Wednesday, April 19, 2006 2:13 PM
To: Morten, Kristy L SWG
Subject: RE: T&E species list

Attachments: morten_kristy_041906.zip
Hi Kristy,

Attached you will find a .zip file that contains the response to your information request. Contained in the .zip file is a county list of T&E and Rare species elemental occurrences for Galveston County as you requested. This list contains information for species that we may not have locational data for at this time, but may be in the area. Lastly, the .zip file also contains documents that will guide you in appropriate use of the data, definition and restrictions of the data, and data interpretation.

I am now answering all information requests so if you need anything else or have any questions let me know!

These data are not all inclusive and **cannot** be used as presence/absence data. They represent species that could potentially be in your project area. This information cannot be substituted for on-the-ground surveys. For the USFWS species lists please visit:
http://ecos.fws.gov/tess_public/servlet/gov.doi.tess_public.servlets.EntryPage

Stephanie

Stephanie Shelton

Natural Diversity Database Technician

Texas Parks and Wildlife Department
3000 IH-35, Suite 100
Austin, TX 78704
office: 512.912.7053; fax: 512.912.7058
stephanie.shelton@tpwd.state.tx.us

*** BIRDS ***

Arctic Peregrine Falcon (*Falco peregrinus tundrius*) - potential migrant	DL	T
Attwater's Greater Prairie-chicken (*Tympanuchus cupido attwateri*) - open prairies of mostly thick grass one to three feet tall; from near sea level to 200 feet along coastal plain on upper two-thirds of Texas coast; males form communal display flocks during late winter-early spring; booming grounds important; breeding February-July	LE	E
Bald Eagle (*Haliaeetus leucocephalus*) - found primarily near seacoasts, rivers, and large lakes; nests in tall trees or on cliffs near water; communally roosts, especially in winter; hunts live prey, scavenges, and pirates food from other birds	LT-PDL	T
Black Rail (*Laterallus jamaicensis*) - salt, brackish, and freshwater marshes, pond borders, wet meadows, & grassy swamps; nests in or along edge of marsh, sometimes on damp ground, but usually on mat of previous year's dead grasses; nest usually hidden in marsh grass or at base of Salicornia		
Brown Pelican (*Pelecanus occidentalis*) - largely coastal and near shore areas, where it roosts on islands and spoil banks	LE	E
Henslow's Sparrow (*Ammodramus henslowii*) - wintering individuals (not flocks) found in weedy fields or cut-over areas where lots of bunch grasses occur along with vines and brambles; a key component is bare ground for running/walking; likely to occur, but few records within this county		
Mountain Plover (***Charadrius montanus***) - shortgrass plains and plowed fields (bare, dirt fields); primarily insectivorous; winter resident in this area		
Piping Plover (*Charadrius melodus*) - wintering migrant along the Texas Gulf Coast; beaches and bayside mud or salt flats	LT	T
Reddish Egret (*Egretta rufescens*) - resident of the Texas Gulf Coast; brackish marshes and shallow salt ponds and tidal flats; nests on ground or in trees or bushes, on dry coastal islands in brushy thickets of yucca and prickly pear		T
Snowy Plover (*Charadrius alexandrinus*) - wintering migrant along the Texas Gulf Coast beaches and bayside mud or salt flats		
Tern (*Sterna fuscata*) - predominately "on the wing"; does not dive, but snatches small fish and squid with bill as it flies or hovers over water; breeding April-July		T
Swallow-tailed Kite (*Elanoides forficatus*) - lowland forested regions, especially swampy areas, ranging into open woodland; marshes, along rivers, lakes, and ponds; nests high in tall tree in clearing or on forest woodland edge, usually in pine, cypress, or various deciduous trees		T
White-faced Ibis (*Plegadis chihi*) - prefers freshwater marshes, sloughs, and irrigated rice fields, but will attend brackish and saltwater habitats; nests in marshes, in low trees, on the ground in bulrushes or reeds, or on floating mats		T
White-tailed Hawk (*Buteo albicaudatus*) - near coast on prairies, cordgrass flats, and scrub-live oak; further inland on prairies, mesquite and oak savannas, and mixed savanna-chaparral; breeding March-May		T
Whooping Crane *(Grus americana*) - potential migrant; winters in and around Aransas National Wildlife Refuge and migrates to Canada for breeding; only remaining natural breeding population of this species	LE	E

Wood Stork (*Mycteria americana*) - forages in prairie ponds, flooded pastures or fields, ditches, and other shallow standing water, including salt-water; usually roosts communally in tall snags, sometimes in association with other wading birds (i.e. active heronries); breeds in Mexico and birds move into Gulf States in search of mud flats and other wetlands, even those associated with forested areas; formerly nested in Texas, but no breeding records since 1960		T

*** BIRDS-RELATED ***

Colonial waterbird nesting areas - many rookeries active annually

Migratory songbird fallout areas - oak mottes and other woods/thickets provide foraging/roosting sites for neotropical migratory songbirds

FISHES

American Eel (*Anguilla rostrata*) - most aquatic habitats with access to ocean; spawns January-February in ocean, larva move to coastal waters, metamorphose, then females move into freshwater; muddy bottoms, still waters, large streams, lakes; can travel overland in wet areas; males in brackish estuaries

*** MAMMALS ***

Black Bear (*Ursus americanus*) - within historical range of Louisiana Black Bear in eastern Texas, Black Bear is federally listed threatened and inhabits bottomland hardwoods and large tracts of undeveloped forested areas; in remainder of Texas, Black Bear is not federally listed and inhabits desert lowlands and high elevation forests and woodlands; dens in tree hollows, rock piles, cliff overhangs, caves, or under brush piles	T/SA; NL	T
Louisiana Black Bear (*Ursus americanus luteolus*) - possible as transient; bottomland hardwoods and large tracts of inaccessible forested areas	LT	T
Plains Spotted Skunk (*Spilogale putorius interrupta*) – catholic in habitat; open fields, prairies, croplands, fence rows, farmyards, forest edges, and woodlands; prefers wooded, brushy areas and tallgrass prairie		
West Indian Manatee (*Trichechus manatus*) – Gulf and bay system; opportunistic, aquatic herbivore	LE	E

*** MOLLUSKS ***

Pistolgrip *(Tritogonia verrucosa*) - stable substrate, rock, hard mud, silt, and soft bottoms, often buried deeply; east and central Texas, Red through San Antonio River basins

*** REPTILES ***

Alligator Snapping Turtle (*Macrochelys temminckii*) - deep water of rivers, canals, lakes, and oxbows; also swamps, bayous, and ponds near deep running water; sometimes enters brackish coastal waters; usually in water with mud bottom and abundant aquatic vegetation; may migrate several miles along rivers; active March-October; breeds April-October		T
Atlantic Hawksbill Sea Turtle (*Eretmochelys imbricata*) - Gulf and bay system	LE	E
Green Sea Turtle (*Chelonia mydas*) - Gulf and bay system	LT	T

Gulf Saltmarsh Snake (*Nerodia clarkii*) - saline flats, coastal bays, & brackish river mouths		
Kemp's Ridley Sea Turtle (*Lepidochelys kempii*) – Gulf and bay system	LE	E
Leatherback Sea Turtle (*Dermochelys coriacea*) - Gulf and bay system	LE	E
Loggerhead Sea Turtle (*Caretta caretta*) - Gulf and bay system	LT	T
Smooth Green Snake (*Liochlorophis vernalis*) - Gulf Coastal Plain; mesic coastal shortgrass prairie vegetation; prefers dense vegetation		T
Texas Diamondback Terrapin (*Malaclemys terrapin littoralis*) - coastal marshes, tidal flats, coves, estuaries, and lagoons behind barrier beaches; brackish and salt water; burrows into mud when inactive; may venture into lowlands at high tide		
Texas Horned Lizard (*Phrynosoma cornutum*) - open, arid and semi-arid regions with sparse vegetation, including grass, cactus, scattered brush or scrubby trees; soil may vary in texture from sandy to rocky; burrows into soil, enters rodent burrows, or hides under rock when inactive; breeds March-September		T
Timber/Canebrake Rattlesnake (*Crotalus horridus*) – swamps, floodplains, upland pine and deciduous woodlands, riparian zones, abandoned farmland; limestone bluffs, sandy soil or black clay; prefers dense ground cover, i.e. grapevines or palmetto		T

*** VASCULAR PLANTS ***

Coastal gay-feather (*Liatris bracteata*) - endemic; black clay soils of prairie remnants; flowering in fall

Correll's false dragon-head (*Physostegia correllii*) – wet soils including roadside ditches and irrigation channels; flowering June-July

Grand Prairie evening primrose (*Oenothera pilosella* ssp. *sessilis*) known in Texas from a single collection made in the 1850's from Galveston Island; elsewhere known from sandy soils in low rises in Mississippi Delta; flowering May-June

Houston daisy (*Rayjacksonia aurea*) - endemic; seasonally wet, saline barren areas, around the base of mima mounds in coastal prairies, or barren to somewhat vegetated openings in grasslands, including pastures and roadsides, on loamy to sandy loam soils; flowering October-November

Texas windmill-grass (*Chloris texensis*) - endemic; sandy to sandy loam soils in open to sometimes barren areas in prairies and grasslands, including ditches and roadsides; flowering in fall

Threeflower broomweed *(Thurovia triflora*) - endemic; black clay soils of remnant grasslands, also tidal flats; flowering July-November

Status Key:

LE, LT	- Federally Listed Endangered/Threatened
PE, PT	- Federally Proposed Endangered/Threatened
E/SA, T/SA	- Federally Listed Endangered/Threatened by Similarity of Appearance
C1	- Federal Candidate for Listing, Category 1; information supports proposing to list as Endangered/Threatened
DL, PDL	- Federally Delisted/Proposed for Delisting
NL	- Not Federally Listed
E, T	- State Listed Endangered/Threatened
"blank"	- Rare, but with no regulatory listing status

Additional Agency Coordination/Consultation Letters

APPENDIX F

Public Meetings

APPENDIX G

References

Enright, J.J. and J.M. Enright and R.L. Gearhart II and D.S. Jones
2005 Diving Assessment of Two Anomalies for Historic Properties Investigations, Texas City Channel Improvements Project, Galveston County, Galveston Bay, Texas. Prepared for USACE, Galveston District

Gearhart, R.L. II and D.S. Jones and J.M. Enright and J. Enright and T. Summerville
2005 Close-Order Remote-Sensing Survey of Five Anomalies and Proposed Channel Modifications for Historic Properties Investigations, Texas City Channel Improvements, Galveston Bay, Texas. Prepared for USACE, Galveston District.

Hoyt, S.D. and E.R. Foster and J. S. Schmidt
1998 Intensive Archival Research, Close-Order Magnetometer Survey, Dating, and Offshore Diving, Houston-Galveston Navigation Channels, Texas Project, Galveston Harris, Liberty and Chambers Counties, Texas Offshore, Galveston

Jones. D.S. and J.M. Enright and J. Watts and R.L Gearhart II.
2002 Side-Scan Sonar, Magnetometer and Bathymetry survey to map oyster Habitat and Submerged Cultural Resources for the Proposed Shoal Point Container Terminal, Galveston Bay, Texas. Prepared for the City of Texas City.

U.S. Army Corps of Engineers, Galveston District, 1998. Consistency Determination for Texas City Channel, Texas for the Texas Coastal Coordination Council, July 10, 1998.

APPENDIX H

HQUSACE Economic Guidance

APPENDIX I

BOILOGICAL ASSESSMENT